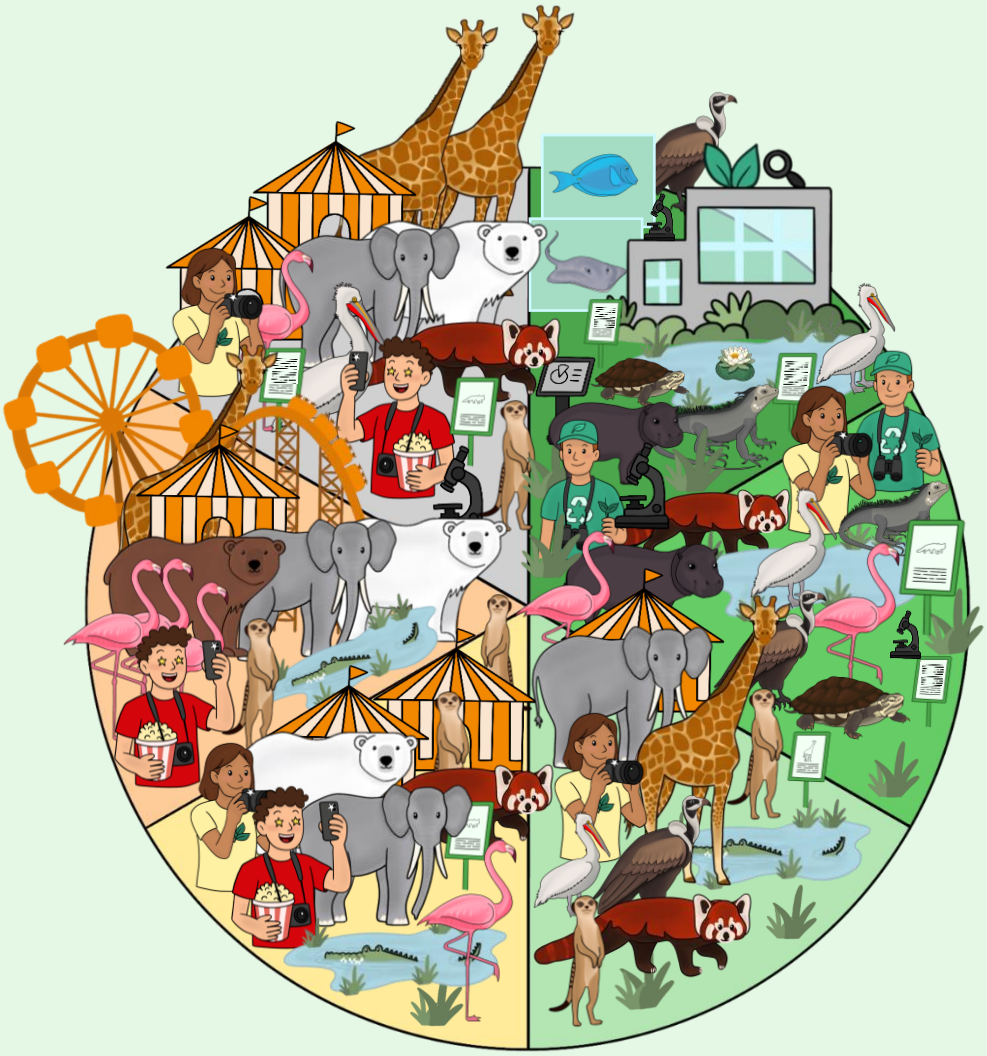
LEARNING FROM ROFFAREEFS: LEVERAGING INSIGHTS TO DESIGN A STRATEGIC DECISION-SUPPORT TOOL FOR DEFINING AND POSITIONING DIERGAARDE BLIJDORP'S ROLE IN NATURE CONSERVATION



Graduation Report
Sanne Grommers
MSc Thesis Strategic Product Design
Delft University of Technology | July 2025
In collaboration with RoffaReefs and Diergaarde Blijdorp – Rotterdam Zoo

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Executive summary

This study addresses the research question "*How can zoos be enabled to define and position their role in nature conservation and explore different strategic scenarios while gaining insight into their operational and stakeholder implications?*". Diergaarde Blijdorp (hereafter 'Rotterdam Zoo') serves as the primary case organisation. The study employed a mixed-methods approach combining literature review, historical and trend analysis, case study research, stakeholder interviews, and participatory design.

Zoo transformation: The study investigated how the role of zoos has historically developed, Rotterdam Zoo's current positioning, and emerging trends creating both pressures and opportunities that necessitate a transformation away from the traditional entertainment-based zoo model. This transformation is driven by changing public perceptions, financial sustainability challenges, and evolving nature conservation expectations. Zoo transformation is inevitable rather than optional, with zoos facing a fundamental choice between nature conservation leadership or risking a decline in relevance. The 'One Plan Approach' (coordinated conservation across captive and wild populations) offers a proven framework for transformation, but requires fundamental organisational change. Long-term legitimacy and relevance depend on zoos' ability to redefine their institutional purpose and align all operations with clear nature conservation goals.

Masterplan 2050: Rotterdam Zoo's strategic response to these transformation pressures is outlined in their Masterplan 2050, which aims to transform the zoo into a nature conservation and restoration organisation. The analysis explored what the strategic challenges and trade-offs would be that complicate its implementation. It became apparent that the zoo has clear nature conservation intentions, but their main challenge is to translate these ambitions into concrete strategic choices. Operational frameworks need to be developed to support this transformation across areas including animal collection strategy implementation, revenue diversification, and practical approaches to *in situ* nature conservation work. Rather than expanding further, the challenge now lies in narrowing focus and a wider need for structured decision-making.

Case study: A key question is how nature conservation or restoration commitments translate into effective *in situ* practice. A case study was performed to learn from the approach taken by the Rotterdam Zoo-led coral reef restoration programme called RoffaReefs on Bonaire, and to identify what factors are important for successful nature conservation initiatives and partnerships. This case study reveals that successful nature conservation requires designing for *socio-ecological ecosystems*; it must simultaneously address natural processes, scientific understanding, and human social dynamics. This finding fundamentally challenges approaches that prioritise technical solutions only. Moreover, authentic nature conservation requires genuine partnership development with local stakeholders (community co-ownership) and commitments to be aligned with organisational capabilities.

Decision support tool: Results of the research have been translated into the design of a strategic decision-support tool ("Zoo Nature Conservation Choice Compass") that supports zoos in defining and positioning their role in nature conservation by exploring different transformation scenarios, gaining insight into operational and stakeholder implications. Through iterative co-creation sessions involving Rotterdam Zoo and RoffaReefs stakeholders, the choice compass concept was refined and validated, with development of testing protocols, integration methods, and recommendations for continued validation and implementation.

The resulting choice compass successfully bridges the gap between nature conservation aspirations and operational reality, providing zoos with concrete frameworks for strategic decision-making, and supporting Rotterdam Zoo's transformation towards its 2050 conservation objectives.

List of Abbreviations

- AZA: Association of Zoos and Aquariums
- BCSC: Blijdorp Conservation and Science Centre
- CPSG: Conservation Planning Specialist Group
- DCNA: Dutch Caribbean Nature Alliance
- Diergaarde Blijdorp: Stichting Koninklijke Rotterdamse Diergaarde
- EAZA: European Association of Zoos and Aquariums
- EEP: EAZA Ex Situ Programmes
- IUCN: International Union for Conservation of Nature and Natural Resources
- RDA: Raad voor Dierenaangelegenheden (Council on Animal Affairs)
- SSC: Species Survival Commission
- STCB: Sea Turtle Conservation Bonaire
- STINAPA: Stichting Nationale Parken Bonaire
- WAZA: World Association of Zoos and Aquariums

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Summary Chapter 1: Global biodiversity decline and growing societal expectations for sustainability action across all sectors pressure organisations to demonstrate genuine environmental impact. This trend particularly affects zoological institutions, which face mounting demands to prove measurable nature conservation contributions rather than maintaining traditional entertainment-focused operations. Many zoos develop ambitious nature conservation strategies but would benefit from practical tools for translating these into strategic positioning decisions while balancing operational constraints. The primary objective of this research is to develop a decision-support tool that helps zoo staff navigate nature conservation positioning decisions. This research addresses this need by studying Diergaarde Blijdorp (Rotterdam Zoo) and their RoffaReefs coral reef restoration programme, which operates on the Dutch Caribbean island of Bonaire. This chapter provides an overview of the project, detailing its context, approach, and the parties involved.

Chapter 1. Project introduction: zoo nature conservation transformation

1.1 Project context and research challenge

1.1.1 Why zoo transformation matters now

In recent decades, environmental challenges have become impossible to ignore. Biodiversity decline has reached alarming levels, with over one million species threatened with extinction and wildlife populations declining by 73% since 1970 (United Nations, n.d.; WWF, 2024). Climate change and habitat destruction accelerate ecosystem collapse worldwide (United Nations, n.d.). As awareness of these crises grows, society increasingly expects organisations to demonstrate measurable environmental action rather than symbolic gestures (European Parliament, n.d.).

This shift particularly affects zoological institutions, which have a direct connection to the biodiversity crisis through their animal collections and conservation work. Growing public awareness of animal welfare and nature conservation ethics creates mounting criticism of traditional zoo models built around animal display and visitor entertainment. Simultaneously, the biodiversity crisis creates urgent demand for effective nature conservation organisations capable of meaningful environmental impact.

For zoos, this convergence represents both existential challenge and strategic opportunity. Those maintaining traditional entertainment-focused operations risk declining relevance and legitimacy, while institutions successfully transitioning towards nature conservation leadership can establish new forms of societal value. However, many zoos face challenges with this transition, finding themselves caught between nature conservation ambitions and operational reality, requiring clearer frameworks for translating sustainability goals into daily operations.

1.1.2 The knowledge gap in zoo transformation

Many zoos today develop ambitious nature conservation strategies but face the challenge of implementing them effectively. Diergaarde Blijdorp (in this study referred to as ‘Rotterdam Zoo’) demonstrates this challenge with strategic planning that shows clear nature conservation commitment and goals such as contributing to species recovery, yet similar to many institutions, they would benefit from practical tools to evaluate different nature conservation positioning options and understand the implications of strategic choices.

The research addresses a critical knowledge gap in zoo transformation. Many institutions develop ambitious nature conservation strategies and commit to environmental leadership through strategic plans, yet few have access to evidence-based tools for making strategic positioning decisions. These tools are needed to help translate nature conservation ambitions into practical choices that account for operational constraints and stakeholder expectations. The knowledge gap is particularly urgent as zoos need practical guidance to demonstrate meaningful nature conservation impact and maintain social legitimacy. This challenge creates the need for a decision-support tool that helps zoo teams navigate these complex positioning decisions based on real nature conservation practice insights.

1.2 Project scope and research questions

Research objectives

This research develops a practical decision-support tool for zoological institutions exploring nature conservation positioning strategies. This tool helps organisations navigate complex positioning decisions while balancing organisational constraints and stakeholder expectations. Using Rotterdam Zoo's strategic context and RoffaReefs nature conservation practice as a foundation, the study generates frameworks applicable to zoo teams navigating the transition towards enhanced nature conservation roles while maintaining operational viability.

The study investigates how Rotterdam Zoo can learn from their RoffaReefs coral reef restoration programme to guide broader institutional transformation towards nature conservation leadership. By studying how RoffaReefs operates on Bonaire, the research identifies success factors for nature conservation initiatives that inform zoo nature conservation positioning strategies. Moreover, the research examines how zoos can engage in nature conservation work beyond their institutional boundaries and translates these insights into evidence-based practical guidance for zoo transformation.

The research focuses specifically on strategic decision-making processes, excluding visitor experience design, detailed financial modelling, animal welfare protocols, and facility planning, which are only addressed as strategic context. The study develops strategic frameworks for positioning decisions rather than operational procedures. Geographically, the study centres on Rotterdam Zoo's operations in Rotterdam, the Netherlands, with field research conducted on Bonaire, Caribbean Netherlands.

Furthermore, the research addresses zoo staff across all operational levels, particularly decision-makers including management, but also frontline staff involved in daily operations. Secondary relevance applies to nature conservation professionals in similar institutions.

Primary research question

"How can zoos be enabled to define and position their role in nature conservation and explore different strategic scenarios while gaining insight into their operational and stakeholder implications?"

Sub-questions

1. How has the role of zoos developed historically, how is Rotterdam Zoo currently positioned, and what contemporary trends create both pressures and opportunities that necessitate the transformation of the traditional zoo model towards a redefined societal role?
2. How does Masterplan 2050 reflect Rotterdam Zoo's ambition to become a nature restoration organisation, and what strategic challenges and trade-offs complicate its implementation?
3. What lessons can be drawn from RoffaReefs's approach as an example of a zoo-led *in situ* nature conservation programme, and what factors do stakeholders on Bonaire consider important for successful nature conservation initiatives and partnerships?
4. How can these lessons be translated into a strategic decision-support tool that helps zoo staff explore different strategic scenarios in nature conservation and gain insight into their operational and stakeholder implications?

1.3 Involved parties and their roles

Delft University of Technology

This graduation project concludes the Master's programme in Strategic Product Design at Delft University of Technology (TU Delft). Academic guidance and design expertise were provided by the university throughout the project, with Jan-Carel Diehl and Willemijn Brouwer serving as members of the graduation committee.

Diergaarde Blijdorp – Rotterdam Zoo

Diergaarde Blijdorp, officially named Stichting Koninklijke Rotterdamse Diergaarde and commonly referred to as Rotterdam Zoo, is a zoological and botanical institution located in Rotterdam, the Netherlands (Diergaarde Blijdorp, n.d.a). It is one of the oldest zoos in the country and takes part in a range of national and international programmes focused on species conservation, education, and scientific research. In addition to its public recreation facilities, the zoo supports biodiversity preservation efforts through coordinated breeding programmes and various environmental initiatives (Diergaarde Blijdorp, n.d.a).

Within this graduation project, Diergaarde Blijdorp serves as the organisational context for understanding zoo transformation challenges, providing strategic background and facilitating access to RoffaReefs nature conservation practice. Diergaarde Blijdorp's transformation aspirations and operational constraints inform the decision-support tool development.

RoffaReefs

RoffaReefs is a programme under Diergaarde Blijdorp focused on coral reef restoration in the Caribbean, particularly around Bonaire. Originating from research and experimentation within Diergaarde Blijdorp's Oceanium, the initiative developed a method for breeding and releasing key fish species that maintain coral health (Diergaarde Blijdorp, n.d.b; RoffaReefs, 2022). In collaboration with local stakeholders and conservation organisations, RoffaReefs applies this technique in open sea environments to combat coral reef decline caused by overfishing, pollution, and climate change. The programme forms part of Diergaarde Blijdorp's engagement in ecosystem restoration efforts beyond the zoo's physical boundaries (Diergaarde Blijdorp, n.d.b; RoffaReefs, 2022).

RoffaReefs serves as the primary case study for this research, providing concrete insights into how zoos can engage in nature conservation work beyond their institutional boundaries. Field research on Bonaire examines stakeholder perspectives on nature conservation success factors and explores what enables effective nature conservation initiatives to inform decision-support tool development.

Research independence

Throughout this graduation project, employees affiliated with both Diergaarde Blijdorp and RoffaReefs provided guidance and facilitated introductions to relevant stakeholders. However, the analysis phase of this thesis was conducted independently from Diergaarde Blijdorp and RoffaReefs, ensuring objective evaluation of findings and recommendations.

1.5 Research approach and methodology

This research employs a three-phase mixed methods approach designed to progress from problem identification and understanding to practical solution development and implementation through iterative feedback loops (see Appendix A). This approach enables systematic investigation of Rotterdam Zoo's nature conservation transformation context, nature conservation practice insights, and development of a practical decision-support tool for nature conservation positioning. The research is structured in three consecutive phases, each building on insights from the previous stage through iterative, diverging-converging cycles based on combined elements of the Triple Diamond Model (Marin-Garcia *et al.*, 2020) and Systemic Design Framework (Design Council, 2021). This sequential and iterative approach ensures that tool development incorporates multiple feedback loops and stakeholder perspectives throughout the process.

The three main phases that transform challenge into an outcome are: Problem Discovery, Nature Conservation Practice Analysis, and Solution Development. This structure is visualised in Figure 1. Supporting methodologies are explained in greater detail throughout the report at relevant points.

- **Phase 1: Problem Discovery**
  This phase establishes foundational understanding of zoo transformation challenges through historical analysis, trend research, literature review, financial analysis of Rotterdam Zoo's operational structure. Additionally, an analysis of Rotterdam Zoo's strategic context focuses on their Masterplan 2050, which serves as the organisation's long-term strategic planning document.
- **Phase 2: Nature Conservation Practice Analysis**
  This phase examines how zoos can effectively conduct *in situ* nature conservation through two complementary approaches. First, organisational analysis of Rotterdam Zoo's RoffaReefs programme provides a case study of zoo-led *in situ* conservation through document review, stakeholder mapping, and interviews with programme coordinators. Second, field research on Bonaire employs Q-sort methodology and a grid exercise with 15 representatives from 12 nature conservation organisations to understand success factors and collaboration dynamics from local stakeholder perspectives. Through stakeholder interviews and operational analysis conducted in both the Netherlands and on Bonaire, the research identifies what enables effective zoo-based conservation and what challenges emerge in real-world implementation.
- **Phase 3: Solution Development**
  This phase translates strategic insights into a practical decision-support tool using Theory of Change framework, serious gaming analysis, and participatory design methods, developing and validating six nature conservation positioning scenarios through iterative co-creation sessions with zoo staff.

This progression ensures understanding of transformation challenges informs practical tool development while maintaining academic rigor through the design process.

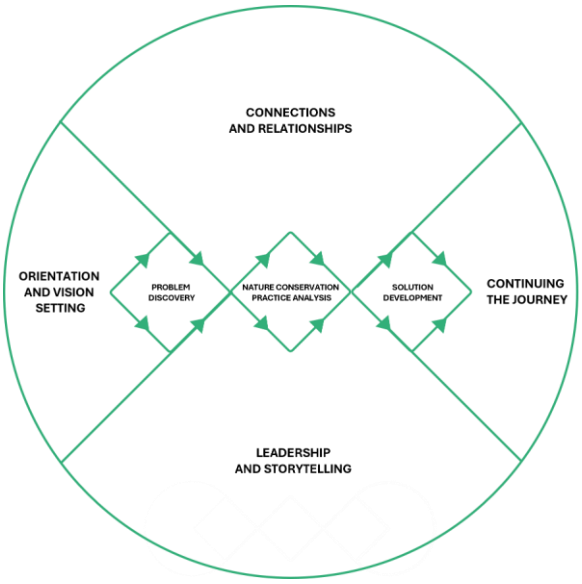

Figure 1: Integrated methodology combining the Triple Diamond model and Systemic Design Framework for this project, based on Marin-Garcia et al. (2020) and Design Council (2021)

Key takeaways

- *Contemporary zoos face an implementation gap between nature conservation ambitions and operational decision-making*
- *RoffaReefs represents a case study of how zoos can engage in nature conservation work beyond traditional institutional boundaries*
- *Strategic positioning decisions require systematic decision-support tools based on real conservation practice insights*

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Summary Chapter 2: This chapter traces the zoo sector's evolution from 19th-century entertainment venues to institutions with conservation missions, examining why traditional zoo models have become unsustainable. Analysis of Rotterdam Zoo's current position reveals critical dependencies on visitor revenue and heritage constraints that limit strategic flexibility. Converging pressures from ethical concerns, nature conservation effectiveness doubts, and financial vulnerabilities challenge zoo legitimacy as biodiversity decline accelerates globally. Regulatory frameworks continue measuring input rather than nature conservation outcomes, while public expectations shift towards demanding measurable impact. Strategic opportunities exist through local species focus, cost-effective smaller species management, and the 'One Plan Approach' (coordinated conservation across captive and wild populations) that could enable measurable nature conservation impact. The chapter concludes that zoo transformation is inevitable rather than optional, with zoos facing a fundamental choice between nature conservation leadership or risking declining relevance.

Chapter 2. From entertainment to nature conservation: zoo sector transformation and contemporary pressures

2.1 Historical development and the emergence of conservation mission

The following historical stages, elaborated below, can be distinguished:

- Early origins and entertainment focus (19th – early 20th century)
- Architectural innovation and wartime resilience (1930s – 1945)
- Post-war modernisation and educational programming (1945 – 1970s)
- Conservation transformation and breeding programmes (1970s – present)

2.1.1 Early origins and entertainment focus (19th – early 20th century)

Historically, zoos and aquariums originated in a world vastly different from today's (Spooner *et al.*, 2023). Their roots trace back to antiquity, where private collections of exotic animals were kept by royalty and wealthy individuals, primarily serving to demonstrate status and power (RDA, 2025; St C. Bostock, 1993). In the 19th century, the first zoos began opening their gates to a broader audience, including pioneering institutions such as Artis and Rotterdam Zoo in the Netherlands (RDA, 2025). This transformation of private institutions into public zoological gardens reflected growing urbanisation and rising societal interest in the natural world (Stadsarchief Rotterdam, 2025).

These early public zoos functioned as 'living museums', showcasing exotic animals for urban populations unfamiliar with wildlife. The emphasis laid primarily on spectacle and novelty, with animals often displayed in cramped, artificial enclosures designed for public amusement rather than animal welfare (Stadsarchief Rotterdam, 2025). In some cases, animals were trained to perform tricks or even functioned as rides. This zoo model prioritised entertainment over nature conservation, a pattern that was widespread across European zoos at the time. Although these zoos were important for public education about animals, ethical considerations remained secondary to visitor attraction (Stadsarchief Rotterdam, 2025).

The early development of Rotterdam zoo exemplifies how this early entertainment-focused development manifested locally. Its institutional origins trace back to 1856, when two railway officials, Mr. van den Bergh and Mr. van der Valk, rented a railway garden ('het Spoortuintje') in Rotterdam's city centre to house their collection of exotic birds (Stadsarchief Rotterdam, 2025). This modest hobby progressively attracted interest from local merchants and traders, who brought additional animals, gradually transforming the aviary into a small zoo that, with various expansions to the grounds, officially became the 'Vereeniging Rotterdamsche Diergaarde' (Rotterdam Zoological Society) in 1857. The zoo's development reflected Rotterdam's growing commercial importance and the city's desire for cultural amenities that would match those of other major Dutch cities (Stadsarchief Rotterdam, 2025).

Much like its contemporaries, Rotterdam Zoo initially operated a commercial venture focused on attracting paying visitors. Housing a wide variety of species, Rotterdam Zoo quickly became a popular destination for urban recreation (ZOOhistory, n.d.). By the 1930s, the original location had become inadequate to accommodate increasing visitor numbers and the growing animal collection (Stadsarchief Rotterdam, 2025). It was decided to move the zoo to its current location, a district in Rotterdam called Blijdorp, to provide better space and modern facilities for both the animals and visitors (ZOOhistory, n.d.). This relocation was supported by the city's ambition to create a more expansive zoological park, comparable to Amsterdam's Artis (Stadsarchief Rotterdam, 2025), and marked a significant institutional transformation for the zoo.

2.1.2 Architectural innovation and wartime resilience (1930s – 1945)

In 1938, the design of the new zoo was entrusted to renowned architect Sybold van Ravesteyn, whose modernist architectural style emphasises aesthetic harmony and innovative enclosure designs that strived to mimic natural habitats and enhance visitor experience (Tap, 2021). Van Ravesteyn's approach was groundbreaking at the time and included the use of natural materials and open, spacious enclosures with barriers such as moats and glass panels rather than metal bars and fencing, which contrasted sharply with traditional cramped enclosures of earlier zoos. The buildings he designed – including the main entrance, the Riviera Hall, administrative buildings, and animal enclosures – remain integral to Rotterdam Zoo's architectural identity and have been carefully preserved as part of the zoo's heritage (Tap, 2021; van Helleman, 2021). These structures were celebrated for their integration of functionality and beauty, setting a new standard for zoos worldwide (Tap, 2021).

The relocation process was nearly derailed by the German invasion of the Netherlands and the devastating bombing of Rotterdam in May 1940, which destroyed much of the city and part of the old zoo Miraculously, the new zoo under construction in Blijdorp survived the attack (IsGeschiedenis, 2022; Smits, 2021; Tap, 2021).. Despite the chaos of war, the zoo officially opened to the public at its new location in December 1940, becoming a symbol of resilience for the people of Rotterdam (Tap, 2021). During the war period, the zoo faced immense challenges, including food shortages for the animals and damage from air raids. Nevertheless Rotterdam Zoo remained a place of solace and hope for Rotterdam's residents, offering a brief escape from the grim realities of war (Smits, 2021; Tap, 2021).

2.1.3 Post-war modernisation and educational programming (1945 – 1970s)

After World War II, Rotterdam Zoo embarked on a period of recovery and institutional development. Implementing Van Ravesteyn's designs, the zoo began modernising its facilities and transitioning away from the outdated 'bars-and-cages' model (Stadsarchief Rotterdam, 2025; Tap, 2021). However, while these new designs created better viewing experiences and used some landscaping elements, they remained primarily concrete-based structures rather than recreated natural ecosystems (Stadsarchief Rotterdam, 2025). At the same time, the post-war period marked a significant shift in institutional philosophy, as Rotterdam Zoo introduced educational programmes to help visitors understand the importance of wildlife and biodiversity. This change reflected a growing public awareness of the need for nature conservation and the role of zoos in fostering a connection between people and wildlife (Stadsarchief Rotterdam, 2025). Together, these spatial and educational developments marked an early phase in the zoo's evolution from entertainment venue to modern zoological institution. In 1957, celebrating its 100th anniversary, the zoo received a royal designation and was henceforth known as "Stichting Koninklijke Rotterdamse Diergaarde" (Royal Rotterdam Zoo Foundation), reflecting its formal recognition as a leading cultural institution (NRC, 2019; Stadsarchief Rotterdam, 2025).

2.1.4 Conservation transformation and breeding programmes (1970s – present)

Building on historical foundations, the classical zoo model was characterised by structured collections of individual animals from around the world, displayed primarily for public viewing and entertainment (RDA, 2025; Spooner *et al.*, 2023). Animal acquisition typically involved taking animals directly from the wild, and enclosures were often cramped and inadequate by today's standards (St C. Bostock, 1993). The contrast between captive conditions and the animals' natural habitats was striking. For instance, a typical polar bear enclosure might be a million times smaller than its natural roaming area (Boucher, 2025). These conditions raised concerns about animal well-being as public awareness developed over time (Boucher, 2025).

In the 1970s and 1980s, biodiversity loss intensified, while habitat destruction and ecological fragmentation reduced the effectiveness of *in situ* nature conservation efforts. In response, zoos began to redefine their purpose around four core conditions: conservation, education, research, and recreation (Spooner *et al.*, 2023). Moving beyond mere display of animals, they increasingly embraced a nature

conservation mission centred on protecting endangered species. "*Captivity for Conservation*" became a crucial slogan for the modern zoo (Keulartz, 2015). A major milestone came with the 1992 Earth Summit, where the *Convention on Biodiversity* was signed. Shortly after, the first *World Zoo Conservation Strategy* (1993) declared that, at a time when species, habitats and ecosystems worldwide are threatened with extinction, zoos must actively commit to species and wildlife conservation (Keulartz, 2015).

Among these pillars, conservation became the primary focus, with the modern zoo envisioned as a 'Noah's Ark' (Keulartz, 2015), or reservoir for species conservation (Barongi *et al.*, 2015). Zoos were increasingly seen as lifeboats for species conservation, fulfilling this role through breeding and reintroduction programmes (Keulartz, 2015; RDA, 2025). Within this model, zoos were positioned as central institutions for *ex situ* conservation (conservation outside natural habitats) (Keulartz, 2015) and owning their primary reason for existence to their contribution to species conservation (Keulartz, 2015). Figure 2 illustrates this distinction. While framed as a nature conservation strategy, these breeding programmes also frequently served as a significant attraction for visitors, with baby animals and breeding success stories becoming marketing tools to draw crowds (Boucher, 2025).

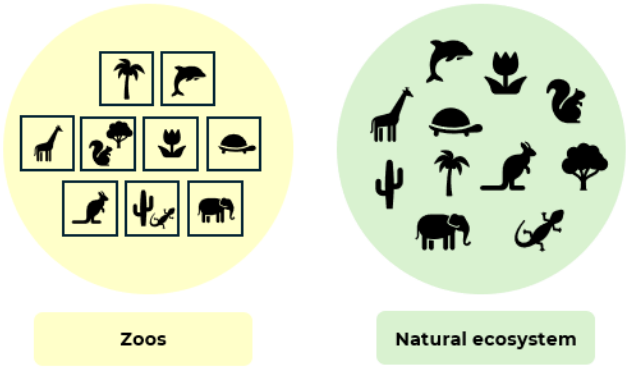


Figure 2: Ex situ conservation (zoos) and in situ conservation (natural habitats)

By the late 20th century, Rotterdam Zoo had established itself as one of Europe's leading zoological institutions (Stadsarchief Rotterdam, 2025). The institutional focus shifted increasingly from merely displaying animals towards creating engaging visitor experiences and raising awareness about the importance of nature conservation (Rotterdam Zoo, n.d.c.). Additionally, Rotterdam Zoo became a leader in international breeding programmes and nature conservation projects, actively participating in efforts to save endangered species (Stadsarchief Rotterdam, 2025). Major renovations and new immersive exhibits, such as the Oceanium, which highlights marine ecosystems and opened in 2001, further solidified its reputation as a modern zoological park (Blijdorper Bende Blog!, 2021). These developments highlighted a broader shift in societal values, with zoos beginning to focus more on nature conservation, education, and research (Rotterdam Zoo, n.d.c.). This transformation reflects Rotterdam Zoo's evolution from its origins as a modest aviary and urban entertainment venue, where animal welfare was not yet a priority, into a modern institution that seeks to balance its role as a popular recreational destination with initiatives in nature conservation, education, and scientific research (Rotterdam Zoo, n.d.c.). This historical evolution provides the foundation for understanding Rotterdam Zoo's current strategic positioning within the broader zoo sector transformation (see Figure 3).

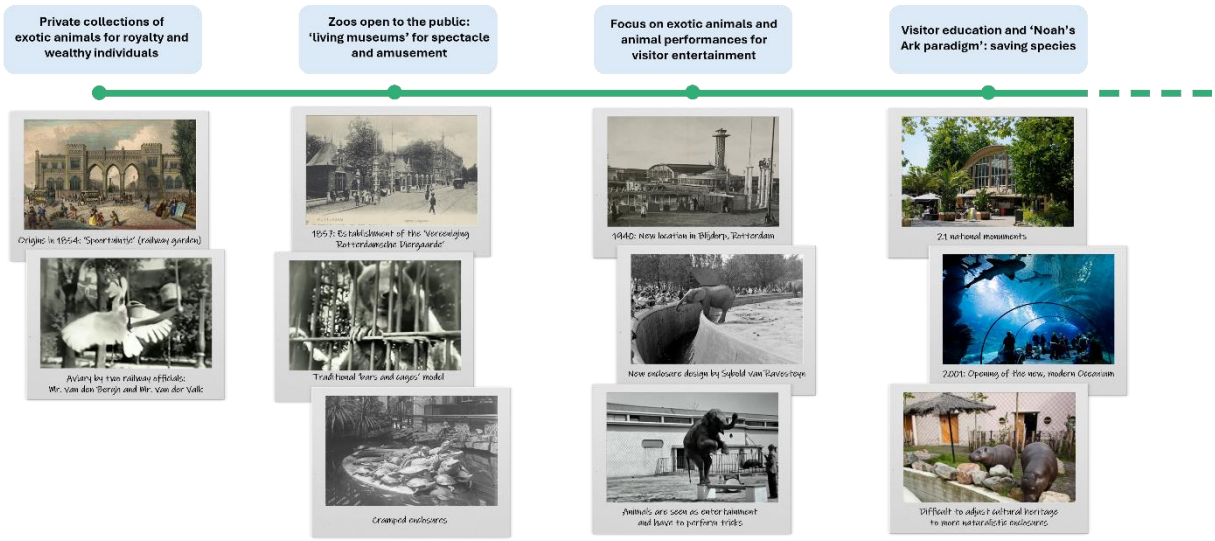


Figure 3: Timeline of Rotterdam Zoo's historical development

Key takeaways

- *Zoo sector has evolved significantly from 1800s entertainment spectacle towards conservation mission, demonstrating institutional capacity for transformation when facing societal pressure*
- *Despite conservation intentions and 'Noah's Ark' positioning (breeding endangered species for reintroduction), most zoos still house predominantly non-threatened species with limited reintroduction success rates, indicating implementation gaps remain between stated conservation goals and operational reality*

2.2 Rotterdam Zoo today: current positioning and operational reality

Having traced Rotterdam Zoo's historical evolution from a modest 19th-century aviary to a modern zoological institution, this section examines how contemporary pressures affect both Rotterdam Zoo specifically and the zoo sector more broadly. Understanding these interconnected challenges provides essential context for the strategic transformation decisions facing modern zoological institutions.

2.2.1 Current positioning and mission

Now, more than 165 years later, Rotterdam Zoo aims to position itself as an international nature conservation organisation, actively engaging in global efforts for species preservation and nature restoration (Rotterdam Zoo, n.d.). Its evolution mirrors the broader transformation seen across the zoo sector, a shift from entertainment-focused institutions towards nature conservation-oriented organisations. While significant progress has been made, this transformation represents an ongoing journey. Rotterdam Zoo, alongside zoos worldwide, continues to navigate the complex transition between traditional zoo operations and contemporary societal nature conservation expectations.

2.2.2 Financial dependencies and vulnerabilities

Rotterdam Zoo's financial architecture reveals critical dependency on visitor-related revenue streams, which account for approximately two-thirds (68%) of total income. Entrance fees and parking (43%) represent the dominant revenue source with 43%, while hospitality and retail operations contribute approximately 25% of revenues. Annual memberships provide 15% of total revenues, offering the most stable income component with predictable recurring revenue (Stichting Koninklijke Rotterdamse Diergaarde, 2023). This structure creates vulnerability to external disruptions affecting visitor numbers and attendance fluctuations. Additionally, the organisation's assets are predominantly tied up in non-mortgageable real estate, limiting financial flexibility and creating dependence on daily operational revenues (Stichting Koninklijke Rotterdamse Diergaarde, 2023).

Government support provides some financial stability at under 6% of total income, with Rotterdam's annual municipal subsidy at €880.000, including specific funding for nature and environmental education programmes, against total revenues exceeding €34,6 million (Stichting Koninklijke Rotterdamse Diergaarde, 2023). This limited public funding places continued emphasis on the commercial performance of the zoo to maintain operational viability through visitor revenue.

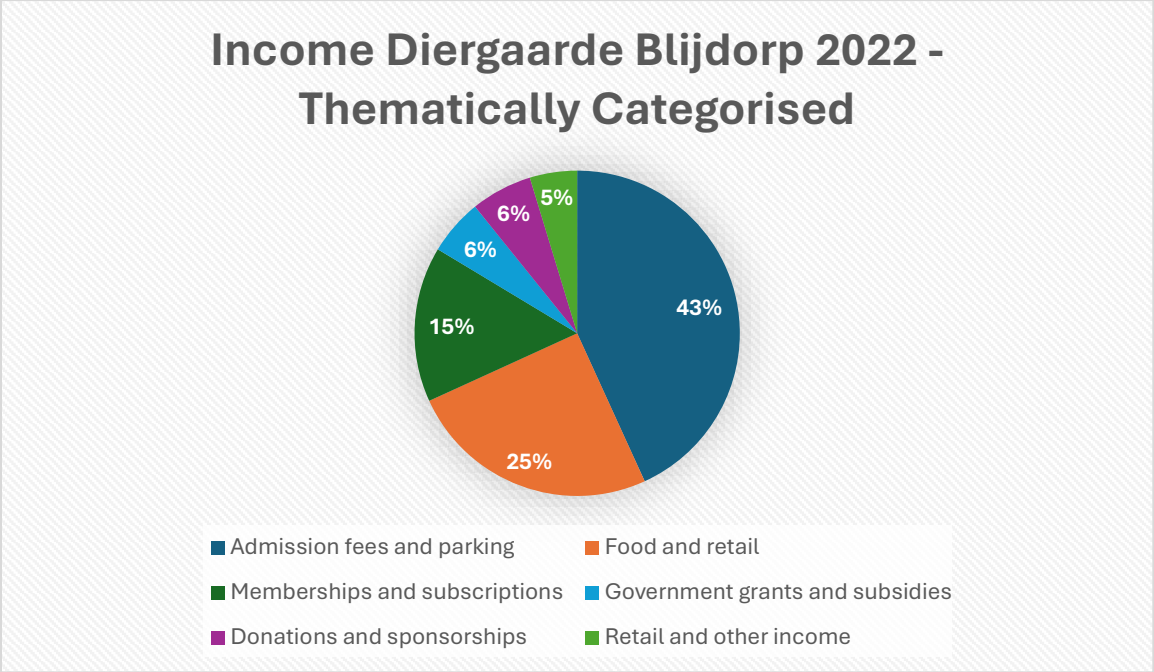


Figure 4: Revenue breakdown of Rotterdam Zoo (Stichting Koninklijke Rotterdamse Diergaarde, 2023)

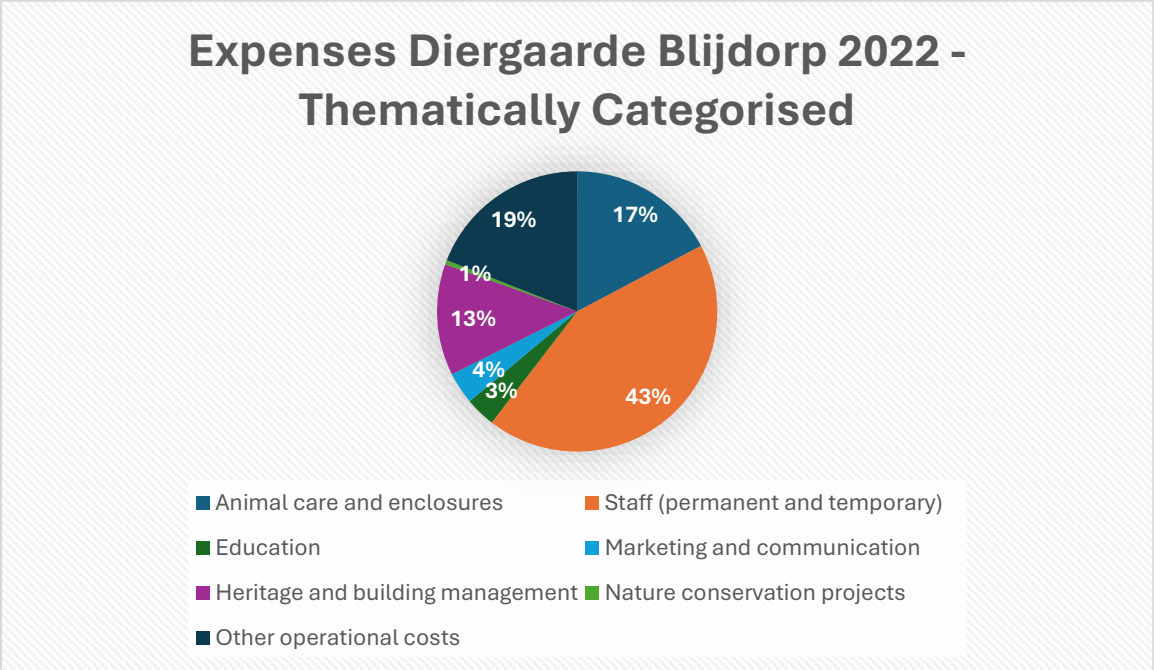


Figure 5: Expenses breakdown of Rotterdam Zoo (Stichting Koninklijke Rotterdamse Diergaarde, 2023)

COVID-19 impact and financial vulnerability

The COVID-19 pandemic served as an unexpected stress test that exposed fundamental vulnerabilities in traditional zoo operations and the current visitor-dependent revenue model. This external disruption highlighted how operational viability relies on a steady flow of visitors, while ongoing obligations such as animal care and facility maintenance continued regardless of income. Extended closures totalling over five months nearly led to bankruptcy, with Rotterdam Zoo losing at least €23 million in turnover throughout the pandemic period (de Wit, 2022).

Recovery was only possible through external support, leaving the organisation without financial reserves for future contingencies (de Wit, 2022). The COVID-19 experience catalysed recognition that business model adaptation was necessary for long-term organisational resilience and relevance, forcing a fundamental reassessment of priorities (Blijdorper Bende, 2023).

Competitive position and market evolution

Following pandemic recovery, Rotterdam Zoo experienced market position challenges that indicated deeper strategic needs. In recent years, consecutive visitor numbers declined while the broader zoo sector experienced 5% growth (Ginder, 2024). This decline resulted in Rotterdam Zoo losing its nine-year position as the Netherlands' most visited zoo (Ginder, 2024). These institution-specific declines in a growing market indicate evolving visitor expectations that traditional approaches are not fully meeting, creating urgency for strategic repositioning to restore competitive relevance.

2.2.3 Operational constraints and heritage obligations

Rotterdam Zoo's staffing costs represent 43% of total expenditure, directly reflecting current collection composition requirements that include over 450 species (Stichting Koninklijke Rotterdamse Diergaarde, 2023). This substantial investment in specialised animal care expertise creates opportunities to reassess collection strategy towards species that maximise nature conservation impact per euro invested.

Heritage preservation and innovation balance

Cultural heritage preservation presents strategic and financial complexities. The organisation maintains 21 national monuments requiring ongoing specialist maintenance, with projects such as the Riviera Hall restoration requiring a €42 million investment (Pretwerk.nl, 2023). While these buildings hold historical value for Rotterdam Zoo, their protected status severely restricts modifications to existing structures and limits available space for new developments such as the innovative but space-intensive Oceanium.

Furthermore, these heritage obligations create structural financial inflexibility beyond mere preservation costs. Specialist restoration consumes significant resources without directly contributing to nature conservation goals, and the national monument status prevents cost-effective modernisation solutions (OPEN Rotterdam, 2025). As a result, these heritage constraints create budget limitations that have indefinitely stalled major planned expansions, leaving management without clear implementation timelines for key animal and conservation facility improvements (Looopings, 2023). **Consequently, Rotterdam Zoo faces the challenge of balancing historical preservation requirements with the need to modernise animal enclosures and expand facilities.**

Fixed cost structure and flexibility enhancement

Animal care and heritage preservation together account for approximately 30% of expenditure, representing largely non-negotiable costs that continue regardless of strategic direction (Stichting Koninklijke Rotterdamse Diergaarde, 2023). These fixed obligations could constrain the organisation's ability to reallocate resources towards nature conservation initiatives, creating a structural restriction to strategic transformation.

Furthermore, operational support costs consume nearly 20% of budget, representing largely fixed administrative expenses that offer limited flexibility for reallocation. However, marketing expenditures presents potential opportunities for strategic reallocation, particularly given substantial investments in branding initiatives, while educational programmes (representing 3,5% of total expenditure) could benefit from enhanced funding to strengthen nature conservation messaging and visitor engagement (Stichting Koninklijke Rotterdamse Diergaarde, 2023).

2.2.4 Current nature conservation investment

In 2022, Rotterdam Zoo allocated €158.872 to nature conservation across 20 global projects, representing 0,46% of its total annual revenue of €34,6 million (Stichting Koninklijke Rotterdamse Diergaarde, 2023). Nature conservation project funding derives primarily from external income sources alongside modest operational contributions, with additional substantial contributions through staff time for research and fieldwork, though these in-kind contributions remain unquantified (Stichting Koninklijke Rotterdamse Diergaarde, 2023). However, the financial pressure to maintain visitor appeal through entertainment continues to create tension between immediate operational needs and longer-term nature conservation investment.

Key takeaways

- *Rotterdam Zoo depends on visitor revenue (68% of income), creating vulnerability to attendance disruptions as demonstrated by near-bankruptcy during the COVID-19 pandemic*
- *Heritage obligations (21 national monuments) limit space and resources for facility modernisation and conservation infrastructure development*

2.3 Converging trends creating transformation pressure and opportunities

Modern zoos operate in an increasingly complex landscape. While institutions such as Rotterdam Zoo aim to evolve into respected centres for education and nature conservation, their legitimacy can no longer be taken for granted. In recent years, modern zoos, including institutions such as Rotterdam Zoo, have come under growing pressure to demonstrate their societal value and ethical legitimacy. This pressure stems from a rapidly changing external environment, where public expectations, policy frameworks, and nature conservation priorities are evolving faster than may institutions can adapt.

2.3.1 Environmental pressures create external demand for measurable nature conservation outcomes

As outlined in Chapter 1, global biodiversity decline places mounting pressure on zoos to demonstrate measurable nature conservation outcomes. Caring for our planet's biological systems is one of the greatest challenges to humankind, and consequently, modern zoos are increasingly expected to take an active role in global nature conservation efforts (Keulartz, 2015). Positioned as the main institutions for *ex situ* conservation, zoos now operate at the intersection of public engagement, animal welfare, and biodiversity protection, requiring them to navigate potential conflicts between animal protectionists and wildlife conservationists (Keulartz, 2015). Professionally, major international organisations such as WAZA, IUCN, and the Convention on Biological Diversity recognise zoos as crucial partners in global conservation efforts,

which creates expectations for zoos to prove their nature conservation value through concrete results rather than good intentions (Barongi *et al.*, 2015; Gusset, 2019).

2.3.2 Ethical concerns and shifting public expectations from entertainment to nature conservation priorities challenge zoo legitimacy

Heightened ethical awareness intensifies animal welfare and captivity concerns

Contemporary criticism of zoos centres heavily on fundamental ethical concerns about animal captivity and welfare (Keulartz, 2015). Animal rights advocates frequently denounce zoos as 'prisons for animals', arguing that their conservation claims merely camouflage underlying cruelty (Boucher, 2025). The fundamental ethical argument holds that any deprivation of liberty of manipulation of sentient animals is morally indefensible, regardless of potential conservation benefits (Keulartz, 2015). Critics argue that keeping animals in captivity is inherently wrong unless benefits clearly outweigh the moral costs, and that zoos may actually compound conservation problems by removing animals from the wild rather than preserving nature (Keulartz, 2015).

Confining animals to enclosures, even if spacious by zoo standards, often leads to tress, boredom, and health problems, especially for species naturally accustomed to roaming large territories (Boucher, 2025). Symptoms manifest as neurotic behaviours such as repetitive pacing, swaying, and biting on bars (Boucher, 2025). SeaWorld's exemplifies these concerns, with orcas dying significantly younger in captivity (30 years) compared to wild life expectancy (80 years) due to chronic health issues and extreme stress (Boucher, 2025).

In the Netherlands, the Council on Animal Affairs (*Raad voor Dieraangelegenheden*, RDA) emphasises that in an 'animal-worthy' zoo, the intrinsic value and integrity of animals must be central, yet acknowledges that captivity inherently compromises this integrity (RDA, 2025). Furthermore, RDA highlights that 50% of Dutch citizens believe some species should not be kept in zoos due to animal welfare concerns, even when overall welfare is deemed sufficient (RDA, 2025). Public surveys reveal that 10% of zoo visitors believe many animals lack adequate living environments, 13% perceive boredom, and 14% feel animals do not have enough space (RDA, 2025). The ethical dilemma of surplus animals presents additional challenges, with healthy individuals culled when there is no space or genetic need in existing populations, as exemplified by the global outrage over Marius the giraffe at Copenhagen Zoo in 2014 (RDA, 2025).

Public expectations shift from entertainment to nature conservation while visitor behaviour remains practically driven

Public expectations have evolved considerably, with visitors now ranking protection and prevention of species extinction as the most important task for zoos, followed by education, while recreation is perceived as less significant (RDA, 2025). However, despite these shifting attitudes towards valuing nature conservation, practical factors such as distance and price remain the primary determinants for visitors in choosing specific zoos, rather than animal welfare considerations (RDA, 2025). This creates a fundamental tension between the zoo's stated nature conservation values and actual visitor behaviour that zoos must navigate.

Similarly, Dutch public opinion shows ambivalence towards zoos: while 60% hope zoos will continue in similar form, 29% desire changes, and nearly 10% wish for their complete disappearance (RDA, 2025). These divided views are reinforced by the fact that zoos in the Netherlands predominantly keep non-threatened species, raising question about their nature conservation priorities (RDA, 2025). Because of these ethical concerns, growing political pressure continues to mount on traditional zoo practices (RDA, 2025).

2.3.3 Conservation effectiveness concerns and modest results undermine zoo credibility

Limited threatened species coverage and low reintroduction success rates undermine conservation effectiveness

A significant criticism is that only 15% of the thousands of species housed in zoos are actually threatened, with an even smaller proportion part of active breeding programmes and very few being successfully reintroduced to the wild (Boucher, 2025; Keulartz, 2015). Research shows zoo conservation efforts remain overwhelmingly focused on vertebrates, which comprise less than five percent of all animal species. Even within this limited scope, zoos hold only 15% of threatened terrestrial vertebrates. Invertebrates, which make up the vast majority of the animal kingdom and are crucial to ecosystem health, remain largely overlooked (Keulartz, 2015). Furthermore, space constraints present significant challenges for zoo-based conservation. The collective space of all zoo animals worldwide covers an area smaller than the city of Amsterdam (212.7 km^2), meaning zoos can maintain only a limited number of endangered species. Optimistic estimates suggest they could accommodate around 800 of the 7.368 threatened vertebrate species (Keulartz, 2015).

The vision of the zoo as a Noah's Ark started to shipwreck as breeding programmes ran into substantial problems. The original ambitious target of maintaining 90% of a species' genetic variability for 200 years (Soulé *et al.*, 1986) as adjusted to 100 years due to practical constraints, such as limited space for maintaining viable populations (Keulartz, 2015). However, the majority of breeding programmes still face challenges in meeting even this revised objective (Keulartz, 2015). Despite the 'Noah's Ark' ideal, success rates of breeding programmes and reintroduction efforts are often disappointing, with animals struggling to regain wild survival skills (Keulartz, 2015). A review by Beck (1995) estimated that only 16 out of 145 reintroduction projects using captive-born animals were successful, with most animals for reintroduction coming from specialised facilities rather than zoos (Keulartz, 2015).

Research bias towards animal captivity improvements and selective publication limits nature conservation contribution

Research activities within the classical zoo model focused on conducting scientific studies to gain knowledge about wild species in relatively controlled environments (RDA, 2025). However, much of this zoo-based research tended to concentrate on improving captive conditions rather than directly contributing to wild species conservation with notable taxonomic bias towards mammals despite fish and birds often being more numerous in collections (Miranda *et al.*, 2023; RDA, 2025). Moreover, research results were not consistently published, particularly when findings might reflect negatively on zoo operations, limiting scientific contribution and transparency (RDA, 2025).

Limited educational impact challenges zoo's social licence to operate

While zoos often claim to provide educational opportunities, research suggests the educational benefits are doubtful at best. A 2014 study found that 62% of children visiting the London Zoo showed no positive learning outcomes (Boucher, 2025). Ultimately, a failure to demonstrate strong, effective conservation action threatens zoos' business models and their 'social licence to operate' (Barongi *et al.*, 2015).

2.3.4 Political pressure, financial dependencies and regulatory challenges shape zoo nature conservation approaches

Growing political pressure and regulatory responses restrict entertainment-focused programmes

Growing public criticism over animal welfare translates into regulatory responses. In the Netherlands, former minister Adema committed in June 2024 to investigate banning public interactions with zoo animals following parliamentary questions (RDA, 2025). Responding to these concerns, zoos increasingly modify or discontinue programmes that prioritise entertainment over animal welfare, exemplifying how institutions adapt to mounting ethical pressures (RDA, 2025). For instance, Rotterdam Zoo discontinued its 'Free Flight'

('*Vrije Vlucht*') bird presentation to align with evolving animal welfare standards (Looopings, 2022), exemplifying how institutions adapt to mounting ethical pressures.

Visitor revenue dependence limits conservation investment and compromises nature conservation goals

Critics argue that despite conservation claims, the primary drivers for many zoos remain entertainment and profit (Boucher, 2025). Despite drawing an estimated 700 million visits annually worldwide, offering a powerful platform to connect people with nature, zoos typically invest less than 5% of their income in *in situ* conservation, which critics view as 'window-dressing' their conservation mission (Barongi *et al.*, 2015; Keulartz, 2015). The need to attract visitors for financial viability can lead to compromises in nature conservation goals, such as continued focus on charismatic species even if some of them are not endangered (Keulartz, 2015; RDA, 2025).

Input-focused regulation enables varied and unquantified nature conservation results

Adding complexity to the debate of zoo's nature conservation role, the Dutch regulatory framework for zoos tends to focus on assessing 'intentions and efforts' (input) rather than measurable 'output' (impact) in nature conservation and education, resulting in varied and often unquantified results across the sector (RDA, 2025). This input-focused regulatory approach reflects broader challenges in defining and measuring zoo effectiveness.

2.3.5 Strategic opportunities for zoo nature conservation transformation

In response to these mounting risks and pressures, the zoo sector has begun identifying strategic opportunities for fundamental transformation that could address these challenges while establishing new forms of legitimacy and effectiveness. The following opportunities are identified:

- Local species focus enhances nature conservation relevance and educational impact
- Smaller species improve cost-effectiveness and offer practical conservation advantages while maintaining visitor appeal
- Metapopulation management maximises conservation impact for both captive and wild populations
- Integrated conservation approaches balances competing demands

Local species focus enhances nature conservation relevance and educational impact

Zoos are pushed to link the animals they display explicitly with *in situ* nature conservation projects, providing visitors with a connection to wild living conditions. A stronger emphasis on local species and biogeographical regions enhances both conservation relevance and educational impact (Keulartz, 2015). This approach aligns with the *Convention on Biological Diversity's* Article 9, which states that *ex situ* conservation should preferably take place in the country of origin (Keulartz, 2015). Figure 6 illustrates the distinction between these conservation approaches. Moreover, educational programmes prove more effective when focused on local species and regional conservation challenges, as people are more likely to engage with issues that directly affect their own environment. In this way, education can foster local involvement and action.

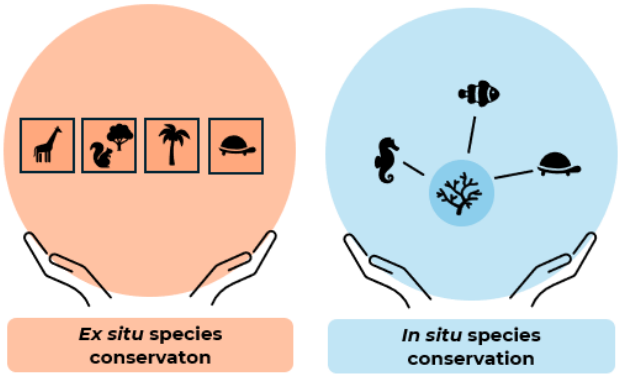


Figure 6: Ex situ species conservation (zoos) and in situ species conservation (natural habitats)

Smaller species improve cost-effectiveness and offer practical conservation advantages while maintaining visitor appeal

A strategic shift away from large charismatic mammals towards smaller species (such as amphibians, invertebrates, and fish) has been proposed, as these animals require less space, are relatively inexpensive to keep, have high birth rates, and are easier to reintroduce into the wild (Keulartz, 2015). The current focus of zoos on charismatic megafauna (such as tigers, elephants, and rhinos) offers a distorted representation of animal kingdom diversity (Keulartz, 2015), given that over 95% of all fauna are small enough to hold in the palm of your hand, yet remain largely absent from zoo collections (Keulartz, 2015). The longstanding assumption that zoos depend on large vertebrates to attract visitors is increasingly being challenged. Recent findings suggest that small mammal displays yield a higher cost-to-benefit ratio in terms of exhibit popularity per unit cost than large mammal displays (Fa *et al.*, 2011). A case in point is Micropia, the first museum of micro-organisms, which opened at Artis Royal Zoo in 2014. Despite its focus on 'non-charismatic' life forms, it has become a popular venue, demonstrating that imaginative displays of small-bodied species can successfully attract and engage zoo audiences (RDA, 2025).

Metapopulation management maximises conservation impact for both captive and wild populations

The integration of *in situ* and *ex situ* programmes through metapopulation management can simultaneously improve the genetic diversity and demographic stability of both captive and wild populations (Keulartz, 2015). This approach involves the exchange of animals both among captive facilities, such as zoos, and between these facilities and natural habitats, addressing the issue of small population sizes that often characterise isolated breeding programmes (Barongi *et al.*, 2015; Gusset, 2019). This interactive exchange is considered an effective strategy to enhance long-term viability in both captive and wild populations while minimising extinction risks (Barongi *et al.*, 2015; Keulartz, 2015).

One Plan Approach offers a framework for balancing captivity and nature conservation

Zoos face increasing tension between their nature conservation ambitions and the ethical and practical challenges of keeping animals in captivity. Beyond individual strategies to increase conservation impact and overcome traditional zoo constraints, the zoo sector is shifting towards integrated conservation planning. The ***'Integrated Approach'*** or ***'One Plan Approach'*** by the IUCN SSC Conservation Planning Specialist Group (IUCN SSC CPSG, n.d.) offers potential to achieve a morally acceptable balance between animal welfare costs and species conservation effectiveness.

The One Plan Approach bridges *in situ* (field-based) and *ex situ* (zoo-based) nature conservation efforts by coordinating species conservation planning across wild and captive populations (Barongi *et al.*, 2015; Gusset, 2019; IUCN SSC CPSG, n.d.). This strategy engages zoo professionals, local communities, government agencies, and scientists in collaborative species management (Barongi *et al.*, 2015). Institutions adopting this approach integrate nature conservation efforts with research, training, education, awareness campaigns, and direct support for *in situ* projects (Keulartz, 2015). Additionally, the One Plan Approach emphasises that excellent animal welfare is fundamental to achieving nature conservation success, developing *'conservation welfare'* principles that aim to ensure positive animal welfare while achieving nature conservation objectives (Mellor *et al.*, 2015). For the One Plan Approach to be ethically and practically successful, Keulartz (2015) notes that it requires zoos to genuinely centre their core activities on wildlife conservation and ensure that their species collection clearly reflects nature conservation goals. Without such alignment, the ethical legitimacy of the approach may be called into question.

This integrated way of working is becoming increasingly urgent. As with zoo populations, many wild populations have become too small to remain demographically and genetically viable (Minteer & Collins, 2013). Fragmentation, habitat loss, and climate change are accelerating this decline. Subsequently, managing these populations in isolation, whether in the wild or in captivity, is no longer sufficient. Without

continuous monitoring and management, they are likely to go extinct. In such cases, abandoning nature conservation efforts amounts to capitulation to species extinction (Minteer & Collins, 2013).

Given the conservation welfare principles and ongoing ethical concerns raised by animal rights advocates about keeping animals in captivity for conservation, a focus on smaller species (such as reptiles, amphibians, and certain fish) is often suggested. These species are commonly perceived to experience fewer welfare problems in captivity and present fewer behavioural complications during reintroduction compared to large mammals (Keulartz, 2015). However, this assumption may reflect human bias rather than scientific evidence, as smaller species can have equally complex spatial, environmental, and cognitive needs that are challenging to meet in captivity.

As wild populations become increasingly dependent on human intervention, the line between *in situ* and *ex situ* conservation continues to blur. Within this context, traditional ethical objections to captivity become subject to renewed debate, particularly when the alternative is species extinction (Minteer & Collins, 2013).

Key takeaways

- *Zoo legitimacy faces mounting pressure from converging ethical concerns, conservation effectiveness questions, and financial dependencies*
- *Zoo conservation impact remains limited with only 15% threatened species housed and low reintroduction success rates from captive breeding globally, while most institutions invest under 5% of revenue in nature conservation*
- *Public expectations evolve towards prioritising nature conservation over entertainment and demanding measurable nature conservation impact, yet regulatory frameworks continue measuring intentions rather than nature conservation outcomes*
- *Strategic opportunities emerge through local species focus, cost-effective smaller species management, and the One Plan Approach (coordinated conservation across captive and wild populations) to address these challenges*

2.4 Strategic crossroads: why transformation towards integrated nature conservation is inevitable for zoos' institutional survival

In response to these mounting criticisms and the escalating biodiversity crisis, the zoo community is undergoing a significant shift. The long-standing vision of the zoo as a modern-day 'Noah's Ark' is gradually being replaced by the One Plan Approach, a more integrated and conservation-focused framework as outlined above (Barongi *et al.*, 2015; Gusset, 2019; Keulartz, 2015). If this approach is broadly implemented, the zoo sector has the global potential to generate US$1 billion annually for nature conservation (Barongi *et al.*, 2015).

Shifting societal expectations, evolving conservation priorities, and mounting ethical criticisms increasingly challenge traditional zoo operations (Spooner *et al.*, 2023). These pressures, combined with financial vulnerabilities and doubts about nature conservation effectiveness, have created an unsustainable situation for zoos that demands systemic strategic change. The gap between their stated nature conservation aspirations and operational capacity has reached a critical point where traditional approaches can no longer maintain legitimacy or effectiveness. At the same time, the emerging strategic opportunities outlined in this chapter offer potential ways forward and help zoos re-establish their societal relevance. However, this requires that institutions are willing to rethink traditional operational models and embrace strategic transformative change.

Today, zoos are standing at a crossroads (Figure 7). These developments force them to confront a fundamental choice: either fully commit to the nature conservation paradigm and develop into dedicated conservation centres, or risk being perceived as outdated entertainment venues, subject to increasing criticism from both animal protectionists and wildlife conservationists.

For Rotterdam Zoo, these sector-wide developments form the crucial backdrop against which clear strategic decisions must be made about the future of the organisation. The COVID-19 crisis exposed underlying vulnerabilities and catalysed recognition that fundamental business model adaptation was necessary for long-term organisational resilience, creating conditions in which strategic repositioning became essential for institutional survival rather than a long-term consideration. The following chapter examines how Rotterdam Zoo developed its strategic response to these transformation challenges.

Key takeaways

- *Zoo transformation becomes inevitable rather than optional, as traditional entertainment-focused models cannot maintain legitimacy because of ethical criticism or financial viability during external disruptions such as COVID-19*
- *The One Plan Approach (coordinated conservation across captive and wild populations) offers a proven framework for transformation, but implementation requires fundamental organisational change beyond symbolic nature conservation efforts*
- *Long-term legitimacy and relevance depend on zoos' ability to redefine their institutional purpose and align all operations with clear nature conservation goals*

Figure 7: Zoo sector transformation crossroads

3

Summary Chapter 3: This chapter examines Rotterdam Zoo's Masterplan 2050, an ambitious 27-year transformation programme establishing concrete targets to rescue ten endangered species and reposition the zoo as a nature restoration organisation. While the plan represents a strategic shift from entertainment-focused operations towards measurable conservation outcomes, translating these aspirations into operational reality reveals implementation complexities that require careful navigation. The plan introduces multiple organisational frameworks alongside ten ambassador species, while questions remain about collection strategy for the remaining 440+ species. Financial dependencies on visitor revenue (68% of income) and heritage preservation obligations create structural constraints for conservation investment. The analysis identifies tensions between diverse visitor expectations, short-term operational demands versus long-term conservation timelines, and ambitious mission statements versus operational capacity. Strategic opportunities exist through enhanced framework clarity, diversified funding approaches, and systematic stakeholder engagement. The chapter concludes that successful transformation requires moving beyond strategic planning towards systematic implementation with explicit choices about resource allocation, institutional identity, and organisational priorities.

Chapter 3: Rotterdam Zoo's strategic response: Masterplan 2050 analysis

The sectoral pressures outlined in the previous chapter created an urgent imperative for institutional change at Rotterdam Zoo. This chapter examines Rotterdam Zoo's strategic response through Masterplan 2050, exploring how it addresses Rotterdam Zoo's specific transformation challenges. The analysis discusses the vision and examines the practical considerations that influence its implementation within the organisation's operational context.

3.1 Masterplan 2050 overview versus sector trends

3.1.1 Strategic evolution: from Masterplan 2030 to 2050

In November 2023, Rotterdam Zoo launched Masterplan 2050, an ambitious 27-year transformation programme to reposition the zoo as a **'nature restoration organisation'**, a concept that extends beyond established nature conservation approaches to include active ecosystem restoration. While this plan builds on lessons learned from Masterplan 2030, which was presented in 2020, it represents a significant departure from the earlier plan's broader vision to become Europe's "most beautiful zoo" (Masterplan 2030, 2020). Masterplan 2050 establishes more concrete targets, measurable outcomes, and specific timelines compared to its predecessor. Where Masterplan 2030 focused on aesthetic improvements and general nature conservation ambitions, Masterplan 2050 establishes nature conservation impact as the primary measure of institutional success (Rotterdam Zoo, 2020).

3.1.2 Mission transformation and strategic vision: "Together we bring nature back to life"

Responding directly to the sectoral trends identified in Chapter 2, particularly the shift from input-focused regulation to public demand for measurable conservation outcomes, Masterplan 2050 establishes a new organisational mission: *"Together we bring nature back to life"*. This mission is accompanied by a concrete 27-year nature conservation target to demonstrably contribute to the rescue of ten (severely) endangered animal and plant species by 2050 (Rotterdam Zoo, 2020). This target-driven approach represents a shift from previous strategic planning that relied on aspirational statements to one focused on specific measurable outcomes.

Rotterdam Zoo now defines itself as "more than just a zoo"; it is an immersive journey through various impact areas and a call to action for biodiversity conservation" (Rotterdam Zoo, 2020). This positioning represents a significant departure from an entertainment-focused institutional identity towards nature conservation-driven organisational purpose. Subsequently, the emphasis on demonstrable contribution reflects Rotterdam Zoo's recognition that stakeholders now demand concrete proof of nature conservation effectiveness rather than stated intentions.

3.1.3 Masterplan 2050 components

Masterplan 2050 establishes four guiding principles that shape how Rotterdam Zoo intends to contribute to species and ecosystem restoration:

-  **Stop the Loss**
  Stop the Loss: preventing species extinction
-  **Reverse the Red**
  Reverse the Red: removing species from the IUCN Red List of Threatened Species
-  **Expand the Green**
  Expand the Green: habitat restoration
-  **Brighten the Blue**
  Brighten the Blue: marine environment restoration

By adopting this approach, Rotterdam Zoo embraces the emerging One Plan Approach (see Chapter 2). The guiding principles operate alongside six organisational pillars covering:

- **Animal welfare:** serves as the prerequisite for all activities, with systematic monitoring and evidence-based improvements
- **Research:** focuses on advancing biodiversity conservation knowledge through scientific collaboration and contributing to global nature conservation understanding
- **Cultural heritage:** preservation maintains the zoo's historical identity while integrating nature conservation priorities
- **Sustainability:** initiatives aim to reduce the ecological footprint of zoo operations while promoting environmentally conscious visitor behaviour
- **Visitor experience:** aims to foster nature connections through exhibits designed to inspire conservation awareness rather than purely recreational engagement
- **Education:** programmes are planned to inspire conservation awareness and action, moving beyond entertainment towards transformative learning that create 'nature conservationists' rather than entertained guests (Looopings, 2024).

Rather than attempting to contribute to conservation of all 47.000 threatened species worldwide, Rotterdam Zoo selected ten specific ***'impact species'*** as focal points for concentrated conservation efforts. The goal is to demonstrably contribute to removing them from the IUCN Red List of Threatened Species through sustained conservation intervention. These species include the Asian elephant, pygmy hippopotamus, red panda, Rüppell's vulture, Dalmatian pelican, Antillean iguana, Vietnamese pond turtle, common skate, surgeonfish, and Rwandan water lily (Figure 8) (Rotterdam Zoo, 2020).

Impact species are defined as animal and plant species that serve dual roles as individual conservation targets and ecosystem ambassadors representing broader conservation challenges within their natural habitats (Rotterdam Zoo, 2020). They are chosen based on a strategic combination of conservation need and institutional capacity. Selection criteria prioritise species where Rotterdam Zoo already possesses established expertise through European or global population management coordination (EEP), research, or knowledge custodianship for species maintained by only a few institutions worldwide. This pragmatic approach recognises that meaningful conservation impact requires building on existing capabilities rather than attempting to address the most critically endangered species without established institutional experience (Rotterdam Zoo, 2020).

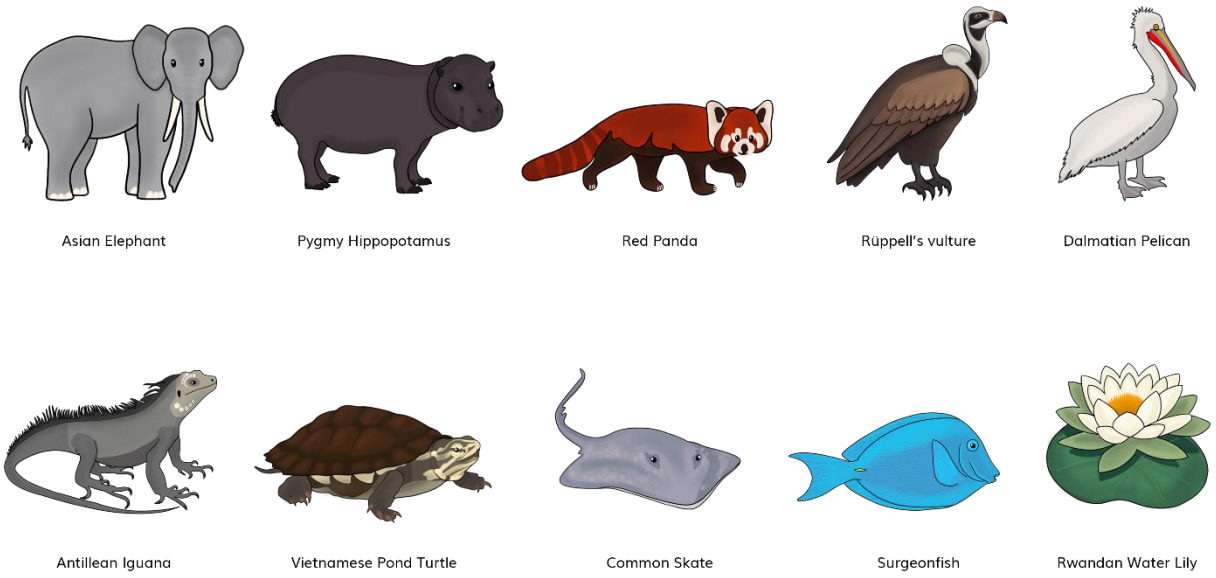


Figure 8: Rotterdam Zoo's ten impact species (Rotterdam Zoo, 2020)

Furthermore, the zoo plans to reorganise its physical space around eight thematic ***'impact areas'*** representing the natural habitats of these ambassador species. Each impact area connects to one or more of the ten ambassador species and represents a region both showcased within the zoo's exhibits (Figure 9) and where Rotterdam Zoo aims to conduct *in situ* nature conservation work (Figure 10). These impact areas include African Plains, African Jungle, Asian Corridors, Himalayan Peaks, Caribbean Coast, Sustainable North Sea, Nature Nearby, and Last Resort (Rotterdam Zoo, 2020). This approach moves away from traditional continental zoo organisation towards nature conservation-focused exhibits. This reorganisation requires significant collection changes, with Rotterdam Zoo discontinuing North American and South American species, including polar bears and vicuñas, to concentrate resources on the chosen regions (Blijdorper Bende!, 2023). The strategic rationale reflects the principle that nature conservation organisations can achieve greater impact by concentrating resources on fewer regions rather than spreading efforts globally.

Figure 9: Spatial reorganisation of Rotterdam Zoo around the eight impact areas

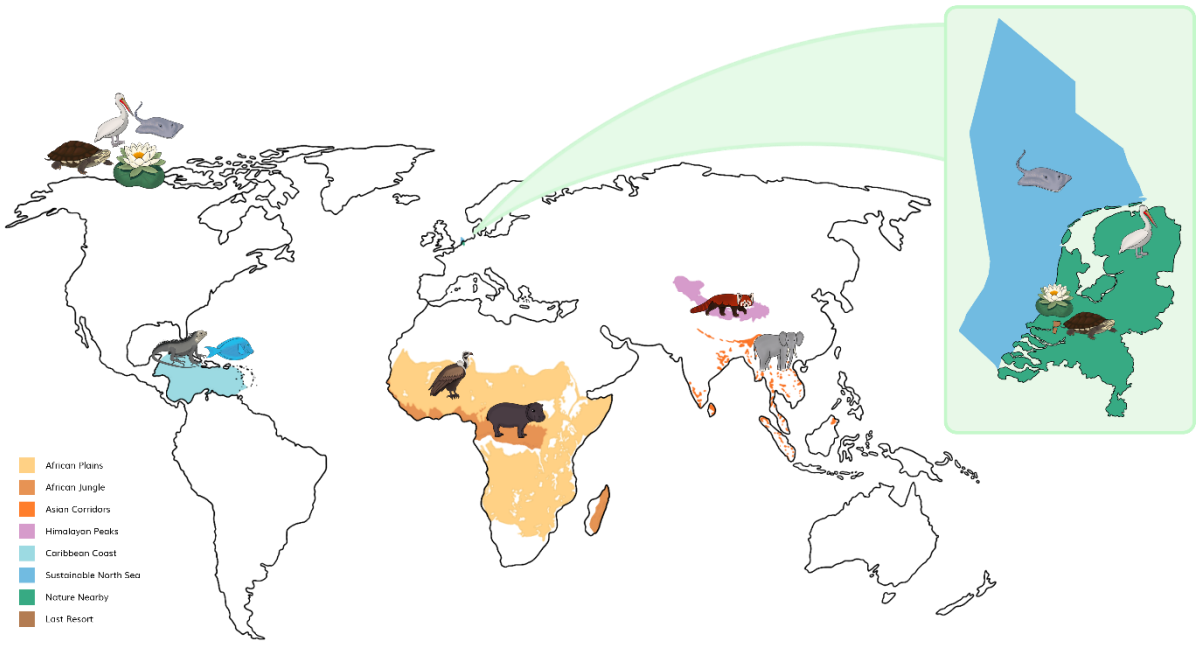


Figure 10: Rotterdam Zoo's eight impact areas representing global nature conservation regions

Additionally, the Masterplan 2050 establishes ***'Blijdorp Hubs'*** as permanent physical presences of Rotterdam Zoo staff and operations in conservation regions such as Bonaire (*'the Caribbean Hub'*) and Nepal, which relate to the impact areas Caribbean Coast and Himalayan Peaks respectively. These hubs are designed to contribute to *in situ* nature conservation work through field research, community collaboration, and habitat restoration activities. With this approach, Rotterdam Zoo aims to extend their conservation activities beyond their physical boundaries and work directly in the natural habitats of some of their ambassador species.

Key takeaways

- *Rotterdam Zoo's Masterplan 2050 represents a strategic shift from traditional entertainment-focused operations towards concrete, measurable nature conservation outcomes with specific targets to rescue ten endangered species and their respective natural ecosystems by 2050, reorganising zoo exhibits around these species' natural habitats and aiming to conduct in situ nature conservation work in the corresponding geographic regions*
- *Species selection prioritises existing institutional expertise and established capabilities alongside conservation need, demonstrating a pragmatic approach to achievable nature conservation impact rather than purely addressing the most critically endangered species*

3.2 Masterplan 2050 analysis: challenges, constraints and opportunities

While Masterplan 2050 presents an ambitious transformation vision, translating these aspirations into operational reality reveals significant challenges that require careful navigation. This analysis examines the communication and implementation challenges that emerge from the Masterplan 2050 and suggests some refinements that could strengthen the plans effectiveness.

3.2.1 Internal structure and terminology complicate external clarity

3.2.1.1 Multiple competing frameworks create external confusion

External stakeholders encounter four conservation principles, six organisational pillars, ten ambassador species, and eight habitat areas, each with distinct terminology and objectives. For visitors and partners unfamiliar with Rotterdam Zoo's operations, these multiple frameworks can create confusion about institutional priorities and actual direction. The Masterplan 2050 provides no clear hierarchy between these different components, leaving unclear which takes precedence when they conflict.

3.2.1.2 Terminology problems compromise communication clarity

The terminology creates challenges for external communication and stakeholder understanding. The term impact species could refer to species that impact ecosystems or species the zoo hopes to impact through nature conservation work. The surgeonfish exemplifies this complexity: while Rotterdam Zoo communicates it as one of their priority conservation species, it is not currently listed as endangered on the IUCN Red List of Threatened Species (IUCN, n.d.a) and is even described as *'non-threatened'* on the zoo's own website (Diergaarde Blijdorp, n.d.c). Instead, the surgeonfish serves as an ecosystem ambassador representing broader marine conservation challenges and playing an important ecological role in threatened coral reef ecosystems rather than requiring species-specific conservation intervention. However, external observers may question why resources are directed towards non-threatened species when Rotterdam Zoo's stated mission focuses on rescuing species from extinction, if this ecosystem ambassador role is not clearly communicated externally.

Similarly, impact areas simultaneously refers to physical zoo exhibits and global ecosystems, creating potential confusion about whether discussions concern local exhibits or worldwide nature conservation efforts. These terminology inconsistencies could create communication challenges with external stakeholders. More precise terminology could improve clarity significantly. Regarding impact species, the term ***'ambassador species'*** would better capture their dual role as conservation targets and ecosystem

representatives. For impact areas, distinguishing between ***'conservation biotopes'*** (global ecosystems) and ***'ecosystem themed exhibit areas'*** (physical zoo spaces) would reduce geographic ambiguity. This would help Rotterdam Zoo communicate their nature conservation mission as intended and avoid misunderstanding about their nature conservation objectives and methods.

3.2.2 Strategic nature conservation role and positioning

3.2.2.1 Collection strategy requires clearer implementation criteria

Perhaps most significantly, the Masterplan 2050 does not yet define what "becoming a nature restoration organisation" means for the 450+ species currently housed at the zoo. While identifying ten ambassador species, the Masterplan 2050 does not address whether or how the remaining 440+ species align with nature conservation goals, what criteria determine collection decisions, or how visitor expectation will be managed during collection changes.

Although Masterplan 2050 provides some direction for exhibit development, it does not clearly define the overall institutional direction regarding this extensive species collection. This can create uncertainty that affects daily operational decisions. Without clear guidance on which species align with nature conservation objectives and which should be phased out, zoo staff cannot make fully informed choices about animal acquisitions, exhibit modifications, or resource allocations. These unresolved collection strategy questions can also create practical and ethical dilemmas regarding animals that are currently housed at the zoo but fall outside the selected conservation biotopes. Discontinuing species such as polar bears raises creates complex challenges as alternative placement options may be limited, leaving an ethical dilemma: maintaining animals in enclosures that no longer meet modern animal welfare standards until they die naturally, or euthanising healthy animals as discussed in Chapter 2. Furthermore, the strategy shows inconsistent application, as the zoo continues to maintain species such as swamp wallabies, which are neither threatened nor align with Rotterdam Zoo's nature conservation focus or institutional expertise. Without a clearly defined institutional direction, nature conservation aspirations risk remaining layered onto traditional zoo operations rather than genuine organisational transformation.

Despite Masterplan 2050's focus on ten priority species, the majority not classified as threatened according to the IUCN Red List of Threatened Species (IUCN, n.d.b). This collection composition reflects conflicting expectations of different visitor segments about what animals they want to see at the zoo. Consequently, this creates a dilemma in visitor management where entertainment-focused visitors are drawn to popular species such as meerkats, Californian sea lions, and flamingos regardless of whether they are endangered or their conservation status, while nature conservation-minded visitors may prefer to see solely genuinely threatened species that need protection. Although some of Rotterdam Zoo's most popular charismatic species are indeed threatened and satisfy both visitor segments, the predominance of non-threatened species may raise questions about resource allocation and institutional priority.

These charismatic threatened animals, particularly large roaming animals such as Asian elephants, Asian lions, reticulated giraffes, and polar bears, present an additional challenge. They continue forming core visitor attractions and institutional identity, following the hypothesis that charismatic species drive visitor appeal, increasing visitor numbers and revenue that could theoretically fund nature conservation initiatives (Stichting Koninklijke Rotterdamse Diergaarde, 2023). However, as discussed in Chapter 2, keeping such large roaming animals raises ethical welfare concerns due to their complex spatial and social needs that are difficult to meet in captivity.

The current collection composition therefore risks creating external confusion when stakeholders observe the gaps in alignment between stated nature conservation priorities and operational reality, including financial allocation and species collection. Additionally, the absence of clear collection criteria creates challenges for managing visitor experiences during the transition from zoo to nature restoration organisation. Without clear strategic choices about which animals to prioritise, the zoo risks attempting to satisfy all visitor segments simultaneously, often resulting in satisfying no one completely.

These choices extend beyond individual species selection to systematic collection strategy: maintaining broad taxonomic diversity versus concentrating on specific conservation species; prioritising visitor appeal versus nature conservation impact; and balancing exotic species versus local wildlife education. As discussed in Chapter 2, smaller species offer significant conservation advantages through reduced housing requirements and cost-effective reintroduction potential (Keulartz, 2015). This alignment between space efficiency and conservation effectiveness offers strategic opportunities for Rotterdam Zoo to enhance both operational sustainability and nature conservation outcomes.

3.2.2.2 Collection strategy: balancing conservation impact and institutional capacity

Rotterdam Zoo's approach to selecting its ten ambassador species reveals the inherent limitations individual institutions face when addressing global nature conservation needs. The species were selected based partly on existing institutional expertise rather than purely conservation urgency, a pragmatic approach that builds on existing capabilities and increases potential for success. However, this selection process exposes a fundamental tension between institutional capacity and nature conservation scale. With approximately 47.000 species currently threatened according to the IUCN Red List of Threatened Species (IUCN, n.d.b), Rotterdam Zoo's commitment to ten ambassador species represents just 0,021% of global conservation needs. This mathematical reality illustrates the enormous gap between what individual zoos can realistically achieve and the scale of the biodiversity crisis. Additionally, it highlights the challenge of reconciling ambitious mission statements with realistic operational boundaries, as well as the need to balance conservation impact and operational feasibility. This requires strategic clarity about organisational roles within the broader nature conservation landscape.

This tension raises fundamental questions about nature conservation strategy, particularly whether institutions should focus on individual species or take ecosystem-based approaches that address entire habitats and the complex relationships between multiple species within them (see Figure 11). These different strategies include:

- **Traditional zoo-based conservation (*ex situ* species conservation)** has historically focused on individual species housed in separate enclosures rather than ecosystem-wide conservation strategies. This *ex situ* approach targets specific animals or plants for captive breeding programmes, population management, and reintroduction efforts. This approach fits well with traditional zoo design where different species live in separate enclosures, and can demonstrate concrete results such as successful breeding programmes that increase captive populations or reintroduction efforts that boost wild populations or specific endangered species.
- ***In situ* species conservation** protects individual species within their natural habitats through measures such as habitat protection, anti-poaching efforts, and wild population monitoring, without removing animals from their natural environment. Although conservation efforts may have beneficial spillover effects on other species sharing the same habitat, the primary focus remains on the target species rather than the broader ecosystem.
- **Ecosystem-focused conservation** takes a fundamentally different approach by addressing entire habitats and recognising that species survival ultimately depends on healthy ecosystems with functioning relationships between multiple species, appropriate climate conditions, and habitat quality. While species-focused approaches can show measurable progress for individual animals and align with traditional zoo design, ecosystem approaches potentially address the root causes of biodiversity loss more comprehensively. However, implementing true ecosystem conservation requires substantial space, funding, and enclosure design changes that challenge existing zoo infrastructure and visitor expectations.

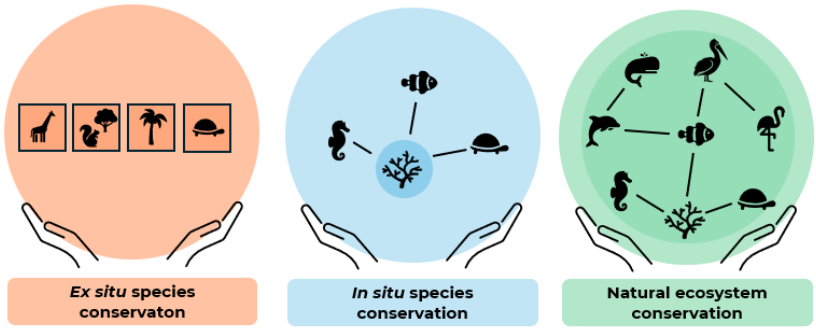


Figure 11: Different approaches to nature conservation (Keulartz, 2015)

Rotterdam Zoo's expertise-based ambassador species selection strategy reflects the practical reality that nature conservation organisations must make strategic choices about resource allocation. However, this approach also highlights the tension between addressing the most critically endangered species worldwide and leveraging existing institutional capabilities for achievable outcomes.

This creates a complex strategic question for zoo-based conservation. Focusing limited resources on ten ambassador species where the institution has established expertise represents sound strategic thinking but raises questions about whether such species-focused approaches can address the interconnected nature of ecological systems. Even if Rotterdam Zoo successfully removes ten species from the IUCN Red List of Threatened Species, their long-term survival depends on healthy ecosystems that support multiple species that depend on each other within those natural environments.

Furthermore, Rotterdam Zoo's ambition to focus on just ten selected ambassador species already represents an extraordinarily undertaking, especially since the Masterplan 2050 commits to "demonstrably contributing to rescue these endangered species and their habitats" within the next 25 years (Rotterdam Zoo, 2020). Species recovery requires comprehensive ecosystem restoration, habitat protection across the species' natural geographic distribution, and long-term population management. Moreover, these efforts require substantial financial resources and sustained collaboration across multiple organisations and governments over decades. This underscores how demanding nature conservation work proves to be, even when focused on a carefully selected subset of threatened species. The absence of detailed implementation metrics in the Masterplan 2050 compounds these concerns, as the plan provides limited financial targets, population recovery goals, or measurable success criteria for the ten species commitment.

3.2.2.3 Operational identity: zoo infrastructure versus nature conservation requirements

Physical zoo infrastructure designed for visitor entertainment creates structural constraints for nature conservation-focused operations. **Traditional zoo layouts** prioritise visitor movement and comfort, aesthetic appeal, and optimal animal viewing. This can be described as 'enclosure thinking' ('*hokjes denken*'), housing single species or small groups in separate enclosures designed primarily for visitor viewing rather than ecosystem function. Most zoo exhibits remain largely concrete structures with limited vegetation, designed to ensure visitors can observe animals clearly at all times rather than replicate their natural ecosystems (Boucher, 2025; Keulartz, 2015). These facilities feature spacious pathways and viewing areas while animals receive limited space in enclosures designed primarily for guaranteed animal visibility and human observation. This approach reflects both physical constraints of urban zoo spaces that are generally too small to mimic natural habitats of large roaming animals and visitor expectations for guaranteed animal visibility. In these zoo models, education generally tends to remain relatively passive through information boards and guided tours.

In contrast, **nature conservation facilities** prioritise recreating natural ecosystems (such as coral reefs or forest environments) where multiple species interact as they would in the wild (Minteer & Collins, 2013). These habitats provide extensive space for natural behaviours and enhanced animal welfare, but often limit visitor sightlines as animals may hide or move naturally within their environment (Keulartz, 2015; Minteer &

Collins, 2013). Visitors become guests in the animals' space rather than the primary focus, while education shifts towards active engagement through citizen science participation and visitor activism programmes that require enhanced educational infrastructure to explain nature conservation concepts (Keulartz, 2015; Minteer & Collins, 2013). Consequently, Rotterdam Zoo must navigate whether to adapt existing visitor-centred individual enclosures for conservation purposes or invest in purpose-built ecosystem-focused habitats where animal welfare takes precedence over guaranteed visibility.

3.2.2.4 Expertise development: traditional animal care versus nature conservation science

Current staff expertise centres on animal welfare and care, veterinary care, and visitor education, reflecting the organisation's traditional zoo operations. However, nature conservation leadership requires additional capabilities in population genetics, habitat restoration, field research coordination, and international conservation partnerships that build upon existing foundational knowledge.

Currently, Rotterdam Zoo engages in nature conservation work through various partnerships and behind-the-scenes activities, though this expertise often remains less visible to the public. The organisation collaborates with EAZA for breeding programmes, supports field conservation projects, and conducts research that contributes to conservation knowledge. Additionally, Rotterdam Zoo has established the '*Blijdorp Conservation and Science Centre'* (BCSC), demonstrating existing commitment to developing conservation science capabilities, though expanding this role requires more prominent conservation science capabilities and greater visibility of existing nature conservation contributions (RDA, 2025).

Rotterdam Zoo faces strategic decisions about enhancing and showcasing internal nature conservation expertise through advanced training for existing staff in nature conservation science, significantly expanding initiatives such as BCSC, recruiting additional specialised conservation scientists/specialists, or further developing partnerships with external conservation organisations while increasing visibility of nature conservation contributions.

3.2.3 Financial structure and strategic constraints

3.2.3.1 Financial constraints complicate nature conservation expansion

Effective nature conservation work requires substantial and sustained financial investment for field research, habitat protection, community engagement, and long-term monitoring programmes. As outlined in Section 2.2.4, Rotterdam Zoo's current spending on nature conservation remains modest in relation to its total revenue, reflecting the early stage of the zoo's strategic transition towards a nature restoration organisation. Nonetheless, this provides a foundation for scaling up nature conservation investment, building on the €1 million annual target outlined in the earlier Masterplan 2030. Masterplan 2050 notably does not specify specific financial commitments, interim benchmarks, or operational indicators that can guide implementation or enable systematic progress evaluation.

While the institution's ambition has been clearly articulated, the current financial and operational balance between traditional zoo operations and conservation outcomes suggests that nature conservation is not yet fully embedded as a core organisational priority. Strengthening this commitment will require clearer prioritisation of nature conservation within both financial decision-making and day-to-day operations. Without such alignment, the credibility of Rotterdam Zoo's nature conservation positioning may be externally questioned, particularly given the combination of modest investment in nature conservation to date and a largely non-threatened animal collection, especially among nature conservation-focused stakeholders who expect resource allocation aligned with stated institutional priorities.

At the same time, the global zoo community demonstrates significant potential for nature conservation investment, with sector analysis indicating capacity to generate US$1 billion annually for nature conservation through coordinated strategic approaches such as the One Plan Approach (Barongi *et al.*, 2015). This creates an opportunity for Rotterdam Zoo to align financial allocation with institutional nature conservation ambitions while contributing to broader sector transformation.

Currently, Rotterdam Zoo notes that nature conservation project funding derives primarily from external income sources alongside modest operational contributions, with additional substantial contributions through staff time for research and fieldwork, though these in-kind contributions remain unquantified (Stichting Koninklijke Rotterdamse Diergaarde, 2023). However, the financial pressure to remain visitor appeal through entertainment continues to create tension between immediate operational needs and longer-term nature conservation investment. Limited public funding places continued emphasis on the commercial performance of the zoo to maintain operational viability through visitor revenue, while Rotterdam Zoo cannot easily reduce visitor appeal to focus on nature conservation without risking the financial stability needed to fund both structural operational costs and nature conservation work. The tension between Masterplan 2050's conservation focus and this revenue dependency creates fundamental implementation challenges, particularly as the plan does not yet offer a clear financial strategy to mitigate this dependency, raising concerns about the feasibility of long-term nature conservation transformation.

Moreover, genuine commitment to nature conservation could potentially unlock access to alternative funding sources that are currently unavailable or limited, such as conservation foundations, environmental trusts, and international biodiversity funds that typically do not support entertainment-focused institutions. This would enable financial diversification towards grants, research partnerships, and nature conservation-focused donations, potentially enhancing operational stability and reducing dependence on traditional visitor revenue. However, this creates a fundamental dilemma: prioritising visitor entertainment maintains current revenue structures but limits nature conservation funding opportunities, while genuine nature conservation focus may initially reduce visitor appeal but offers long-term revenue stability through alternative pathways. Each funding approach implies different stakeholder relationships, accountability frameworks, and operational priorities, with long-term consequences for institutional identity and transformation success.

3.2.3.2 Operational dependencies create strategic trade-offs: balancing visitor revenue with nature conservation objectives

Rotterdam Zoo's current operational model creates structural tension between visitor-dependent financial sustainability and nature conservation ambitions. As outlined in Section 2.2.2, the zoo relies heavily on visitor-generated revenue, making visitor satisfaction essential for maintaining financial stability needed to fund both daily operations and nature conservation investments.

This manifests as a circular dependency requiring careful balance between nature conservation investment and maintaining visitor engagement essential for operational sustainability. Additionally, external conservation funding from donors and sponsors is typically project-specific, further limiting strategic allocation flexibility towards the zoo's own nature conservation priorities.

Limited resources require strategic prioritisation between competing institutional objectives. The organisation faces substantial fixed costs, including specialised animal care, staffing, facility upkeep, and heritage maintenance, as detailed in Section 2.2.2 and 2.2.3. These ongoing operational obligations limit the zoo's financial flexibility and constrain its ability to redirect resources towards nature conservation. Additionally, operational maintenance consumes significant resources while **transformation activities** require additional investment, such as developing new nature conservation programmes, modernising enclosures, and training staff in nature conservation practices. This structure creates vulnerability to attendance fluctuations while increasing dependence on established income streams.

3.2.4 Heritage obligations create structural barriers to conservation transformation

Rotterdam Zoo's operational structure creates multiple barriers to nature conservation transformation. As discussed in Section 2.2.3, heritage obligations and existing infrastructure limit modern, nature conservation-focused exhibit design. Many of the zoo's traditional buildings were constructed for individual species display rather than ecosystem representation. Their national monument status prevents structural modifications and demands specialist restoration approaches, while consuming significant financial

resources without directly contributing to nature conservation outcomes (OPEN Rotterdam, 2025). Furthermore, contemporary animal welfare standards increasingly emphasise naturalistic environments and species-specific behavioural enrichment. These standards require enclosures to simulate real ecosystems rather than function as display boxes, a shift that often demands extensive renovation or complete redesign.

This creates a strategic bottleneck where the same historical identity that gives Rotterdam Zoo part of its uniqueness now potentially becomes a barrier to its transformation to a modern nature restoration organisation. Space, design flexibility, and resource allocation are all constrained by the legal and architectural limits of heritage protection. As a result, the organisation risks trapping resources in maintaining the past, rather than investing in the future. Without resolving this tension between heritage obligations and modern conservation and welfare requirements, transformation will remain blocked at the structural level, regardless of ambition or intent.

3.2.5 Temporal pressures: immediate operational viability versus long-term nature conservation impact

Nature conservation work operates on extended timelines that often conflict with immediate operational demands. Species recovery and ecosystem restoration require decades, while the zoo must meet daily visitor satisfaction and monthly revenue targets. This creates a fundamental tension: meaningful nature conservation investment may not produce visible results for years, yet the zoo needs to justify resource allocation decisions in the short term.

The COVID-19 pandemic exposed this vulnerability. Extended closures nearly led to bankruptcy, forcing Rotterdam Zoo to postpone nature conservation-related investments in favour of basic operational survival, including essential maintenance and cultural heritage restoration projects. This experience demonstrates how short-term external pressures can quickly override long-term nature conservation commitments when immediate institutional survival is at stake.

This temporal mismatch extends to external funding and sponsor expectations. Conservation funding organisations generally recognise the long-term nature of ecosystem recovery, yet some grants still require short-term outputs to justify support. Commercial sponsors in particular often expect immediate, tangible results they can showcase, creating tension with the reality that ecological recovery is gradual and unpredictable. For example, while an organisation may report that a number of corals or trees have been planted this year, survival rates over subsequent years remain highly uncertain. This makes it difficult to promise immediate ecological success, even when the intervention itself is well-designed. Compounded by the broader shift towards output-driven accountability discussed in Chapter 2, this creates a paradox: meaningful nature conservation requires patience and trust in long-term processes, yet regulatory trends and external stakeholders increasingly demand immediate measurable results. Internally, this manifests as a tension between **short-term operational decision**s that focus on maintaining visitor appeal and financial stability and **long-term nature conservation commitments** that require sustained investment in activities that may not generate immediate quantifiable outcomes or public recognition.

However, certain nature conservation activities can demonstrate immediate impact through policy advocacy and legislative change. Nature conservation organisations can actively lobby for protective legislation such as anti-bottom trawling regulations or marine protected area designations, providing measurable short-term outcomes that support long-term nature conservation goals. Additionally, metrics such as financial investment, staff hours, and resources dedicated to nature conservation projects provide quantifiable indicators of commitment and expected impact. While ultimate nature conservation success remains uncertain and time-dependent, these input measures and policy achievements offer accountability mechanisms that bridge the gap between immediate measurement demands and long-term nature conservation realities.

3.2.6 Transformation management: strategic positioning, stakeholder communication, and organisational credibility

3.2.6.1 Visitor segmentation: managing conflicting expectations and strategic implications

Rotterdam Zoo's transformation from a traditional, entertainment-oriented zoo into a nature restoration organisation requires navigating complex stakeholder management challenges, as different visitor segments hold distinct and potentially conflicting expectations (Figure 12). These audiences include:

- **Traditional entertainment-seeking visitors** who seek accessible, enjoyable experiences featuring charismatic animals and may resist nature conservation-focused changes that appear to reduce leisure appeal. This segment currently represents the largest visitor group within Dutch Zoos (RDA, 2025).
- **Nature conservation-focused audiences** who critically assess institutional authenticity, conservation claims, and resource allocation decisions, prioritise animal welfare and express criticism of purely entertainment-oriented zoo models.
- **Hybrid visitors** who expect meaningful nature conservation learning opportunities balanced with engaging and enjoyable experiences. This middle segment demonstrates fluidity, with visitors potentially shifting towards either entertainment or nature conservation priorities depending on institutional messaging and experience design (author interviews with Rotterdam Zoo staff, 2025).

Figure 12: Zoo visitor segmentation

These visitor groups reflect a broader societal evolution in environmental awareness and create opportunities to develop visitor experiences that satisfy diverse audience preferences without compromising nature conservation ambitions. However, each segment brings different revenue potential, engagement requirements, and sources of institutional legitimacy. As a result, the zoo must make strategic positioning decisions about which audiences to prioritise, with cascading implications for communication strategies, programme development, and operational resource allocation.

3.2.6.2 Organisational messaging: aligning internal progress with external credibility

However, external credibility ultimately depends on demonstrable nature conservation outcomes rather than intentions alone. Strategic transformation requires consistent and clear communication about institutional identity and nature conservation contributions to maintain stakeholder credibility. This presents a particular challenge, as internal transformation plans may progress faster than external stakeholder perception. This can create communication challenges where diverse audiences can receive mixed messages about the zoo's organisational priorities, which can potentially undermine credibility even if internal intentions are genuine. Therefore successful transformation demands strategic decisions about communication consistency: whether to maintain tailored messaging for different audience groups or adopt a unified conservation-focused narrative. The latter may build credibility with nature conservation-oriented stakeholders but risks alienating entertainment-seeking visitors. In either case, communication must be aligned with the zoo's actual practices, as misalignment between what is said and what is done risks undermining credibility and stakeholder trust. Additionally, Rotterdam Zoo could enhance visibility of existing research activities, as substantial contributions in this area often remain less visible to external stakeholders.

3.2.6.3 Authentic transformation: accountability through measurable outcomes

Authentic transformation towards nature conservation requires more than external messaging. It demands genuine implementation of nature conservation commitments across the organisation's culture and all operations. As discussed in Chapter 2, stakeholders, particularly nature conservation-oriented visitors, increasingly expect concrete evidence of nature conservation contribution rather than aspirational statements. This reflects the broader sectoral shift from traditional input-focused approaches (intentions and efforts) to outcome-driven accountability.

To meet these expectations, the zoo is under growing pressure to move beyond planning towards systematic implementation that delivers verifiable nature conservation outcomes. This requires making deliberate strategic decisions about its institutional identity, resource allocation, and operational priorities. The choices involve complex trade-offs between competing objectives, such as balancing conservation impact and financial sustainability, or weighing broad visitor appeal against nature conservation focus.

Furthermore, this demands ending incompatible activities and establishing new commitments that align with the zoo's long-term direction. To support this process, the zoos would benefit from systematic evaluation frameworks that help explore the consequences of alternative strategic positions. If nature conservation promises remain unfulfilled without concrete actions and measurable results, the organisation risks reputational damage and potential greenwashing accusations. External stakeholders can only evaluate what is publicly communicated and what is demonstrated in practice; without concrete results, good internal intentions alone do not establish nature conservation legitimacy, making comprehensive implementation essential for transformation success.

3.2.6.4 Participatory organisational transformation and managing strategic partnerships

Additionally, organisational change requires comprehensive internal engagement rather than top-down implementation. In the transformation process, staff must be included and heard in co-creating the organisation's future identity, as employee ownership of the new mission increases transformation success rates significantly (Muller & Druin, 2007). This participatory approach ensures authentic cultural change rather than surface-level adjustments (Busboom, 2023; Étienne, 2014)

Consequently, transformation necessitates accepting that strategic positioning decisions will not appeal to all visitor segments. Full commitment to nature conservation may alienate entertainment-seeking visitors, potentially reducing visitor numbers from this demographic while attracting conservation-minded audiences. However, many entertainment-seeking visitors remain open to change when properly engaged and supported through the transition process. Successful visitor engagement requires acknowledging that humans generally do not favour change and stick to what is 'known', while actively working to bring audiences along through clear communication and inclusive storytelling.

Finally, new institutional positioning requires strategic partnership evaluation. Conservation-focused identity likely conflicts with partnerships involving organisations known for negative environmental impact or purely commercial objectives, necessitating difficult decisions about both relationship continuation and termination. Conversely, authentic nature conservation transformation is expected to open opportunities for new partnerships previously incompatible with traditional zoo positioning. Strategic consistency across all organisational relationships reinforces credibility and authentic transformation.

Key takeaways

- *Multiple organisational frameworks can create external confusion and would benefit from clearer prioritisation hierarchy and more precise terminology to improve stakeholder communication*
- *Beyond the ten selected ambassador species, Rotterdam Zoo must determine collection strategy for its remaining 440+ species, as housing predominantly non-threatened species may raise questions given the zoo's new conservation-focused mission*
- *Heavy visitor-revenue dependency (68% of income) combined with heritage maintenance obligations creates financial vulnerability, highlighting the need for diversified funding approaches to reduce reliance on entertainment-driven income*
- *Entertainment-seeking and nature conservation-minded visitors have conflicting expectations about zoo experiences, requiring strategic choices about which stakeholder groups to prioritise rather than attempting to satisfy all segments equally*
- *Short-term financial pressures conflict with long-term nature conservation timelines, creating implementation challenges that require explicit strategic choices about resource allocation priorities*
- *Scale limitations highlight the challenge of reconciling ambitious mission statements with realistic operational boundaries, requiring strategic clarity about organisational roles within the broader nature conservation landscape*

Conclusion

Rotterdam Zoo's Masterplan 2050 exemplifies sector-wide efforts as it establishes the strategic direction to become a nature restoration organisation. The plan provides guiding principles and ten ambassador species to focus nature conservation efforts, representing a significant commitment to transforming the organisation's role and identity within the nature conservation landscape. However, this chapter has shown that meaningful organisational change involves more than setting ambitious goals. To genuinely evolve into a nature restoration organisation, Rotterdam Zoo will need to define what this mission means in practice and make clear choices that reflect it across all areas of zoo operation. This translation of strategic commitment into concrete operational practice represents the next implementation challenge. Therefore the next phase involves developing the operational frameworks to support this transformation. Areas for further development include collection strategy implementation, revenue diversification, and practical approaches to *in situ* nature conservation work.

Rather than expanding further, the challenge now lies in narrowing focus. This reflects broader transformation challenges facing modern zoos as they shift from traditional operations to nature conservation-focused missions. Structural coherence, consistent communication, and internal alignment are essential if the zoo's nature conservation ambitions are to be fully realised. This includes acknowledging practical limitations, setting realistic expectations, and building trust through transparency and honest engagement with both staff and visitors. Rotterdam Zoo already demonstrates substantial nature conservation engagement through research partnerships, breeding programmes, and field projects. These existing foundations provide valuable experience and capabilities that can support the scaling up of nature conservation activities outlined in Masterplan 2050.

The analysis highlights a wider need for structured decision-making. Transformation involves competing resource demands where different organisational objectives compete for the same funding resources, yet financial resources can only be allocated once. Moreover, transformation decisions are inherently interconnected: collection strategy influences visitor satisfaction and financial requirements, which affect partnership opportunities, which in turn impact stakeholder relationships and communication strategies. There are no truly isolated decisions in organisational transformation. Only by making explicit strategic choices can organisations understand what capabilities they miss and identify how external partners can complement internal resources or what additional competencies must be developed internally for

transformation success. This requires systematic frameworks that can explore trade-offs, assess consequences across multiple criteria, and maintain strategic coherence while adapting to changing circumstances. Moreover, these strategic choices must be made under uncertainty about future market conditions, regulatory developments, societal attitudes towards zoos, political priorities, and nature conservation effectiveness, requiring approaches that acknowledge the complexity and uncertainty inherent in institutional transformation towards nature conservation leadership.

A key question for zoo-led conservation concerns how strategic nature conservation commitments translate into effective *in situ* conservation practice. The following chapter analyses RoffaReefs, a coral reef restoration programme under Rotterdam Zoo on Bonaire, as a case study providing insights into how strategic nature conservation aspirations translate into operational practice.

4

Summary Chapter 4: This chapter examines RoffaReefs, a coral reef restoration programme under Rotterdam Zoo, to understand how zoo-led conservation can effectively translate from strategic aspirations into operational practice. Operating on Bonaire through Rotterdam Zoo's Caribbean Hub, RoffaReefs addresses critical knowledge gaps in reef fish reproduction using innovative floating breeding systems that strengthen entire coral reef ecosystems rather than focusing solely on coral planting. The programme demonstrates effective in situ conservation through its Three-Pillar Approach, integrating nature-based, science-based, and local-based solutions to achieve both ecological impact and community co-ownership. Field research with 15 stakeholders on Bonaire reveals three critical insights that challenge conventional conservation approaches: 1) nature conservation success requires systematic integration of human and natural ecosystems, 2) ecosystem-level thinking proves more effective than species-focused approaches, and 3) successful partnerships depend on clear communication of organisational capabilities and limitations alongside genuine community co-ownership. The analysis demonstrates that effective conservation must function as socio-ecological ecosystem design, simultaneously addressing natural processes, scientific understanding, and social dynamics rather than treating technical solutions as sufficient for conservation success.

H4. Learning from RoffaReefs: zoo-led *in situ* nature conservation

4.1 Case study introduction and programme overview

Reflecting sector-wide transformation aspirations, Rotterdam Zoo's Masterplan 2050 sets ambitious nature conservation targets, yet most zoos' current expertise lies in *ex situ* species management. To explore how a zoo can move 'beyond its gates' and contribute tangibly to ecosystem restoration, this study required a living, field-based reference case. RoffaReefs, a programme under Rotterdam Zoo and its Caribbean Hub, provides exactly that bridge between the zoo and *in situ* nature conservation practice.

4.1.1 RoffaReefs' programme background

RoffaReefs, founded in 2021 by Sander van Lopik, is a programme under Diergaarde Blijdorp that focuses on researching and breeding fish to protect and restore coral reefs, with the ultimate goal of regenerating the wider ocean ecosystem. The programme originated from experimental research conducted in the Oceanium of Rotterdam Zoo, and has since grown into a broader, collaborative effort uniting scientific innovation, nature-based approaches, community knowledge, and a diverse network of national and international partners to address critical knowledge gaps in reef restoration. Furthermore, the RoffaReefs programme now forms part of Rotterdam Zoo's Caribbean Hub on Bonaire.

4.1.2 Rationale for case study selection

RoffaReefs was selected as a case study for this research because it offers a concrete and innovative example of how a modern zoo can actively contribute to *in situ* nature conservation beyond traditional *ex situ* species management. As this study explores how Rotterdam Zoo can strengthen its role in global conservation efforts, RoffaReefs, an initiative that originated within the zoo itself, provides a highly relevant reference point. It demonstrates a direct engagement with the restoration of marine ecosystems in the wild, grounded in scientific research and technological innovation.

In addition, RoffaReefs exemplifies the value of interdisciplinary collaboration in nature conservation practice. The programme brings together academic institutions, local communities, and conservation organisations, showing how multi-stakeholder partnerships can enhance both ecological impact and social legitimacy. Furthermore, RoffaReefs addresses a specific ecological knowledge gap: the reproduction and survival of reef fish, which are essential to coral reef recovery but often overlooked in traditional restoration efforts (Boström-Einarsson *et al.*, 2020). This focus offers an instructive model for how zoos can contribute not just to species protection, but to broader ecosystem regeneration and conservation. By analysing RoffaReefs, this research can extract valuable lessons on how Rotterdam Zoo might expand its conservation impact beyond the zoo's boundaries and contribute more meaningfully to ecosystem recovery on a global scale.

4.1.3 RoffaReefs' nature conservation methodology

Coral reefs rank among the most biodiverse and productive ecosystems on the planet, yet they are critically threatened globally from a variety of human disturbances, suffering severely from the combined effects of overfishing, pollution, and climate change (United Nations, 2022). As a result, coral reefs are declining at an alarming rate (He & Silliman, 2019; O'Hara *et al.*, 2021). The loss of coral reefs not only devastates marine biodiversity, but also poses serious risks to food security, coastal protection, tourism, and the livelihoods of more than 3 billion of people who depend on them (United Nations, 2021). Restoring coral reefs is therefore vital to ensure the well-being of both marine and human communities (Andrello *et al.*, 2021; United Nations, 2021).

While considerable global attention is paid to coral restoration, and restoration efforts have intensified with numerous organisations and projects dedicated to coral planting and cultivation, the crucial ecological

role of reef fish is often overlooked and underestimated (Boström-Einarsson *et al.*, 2020; RoffaReefs, 2025). Not only are fish dependent on coral reefs for shelter and food, they also play a critical role in maintaining reef health. Herbivorous fish, for example, help control algae growth through grazing, which increases the survival rate of juvenile corals and helps prevent disease (Bellwood *et al.*, 2004; Robinson *et al.*, 2019; RoffaReefs, 2025). Additionally, they serve as an important food source for larger predatory species, linking lower and higher trophic levels of the coral reef ecosystem (Figure 12) (Metcalfe *et al.*, 2013; Mumby *et al.*, 2006).

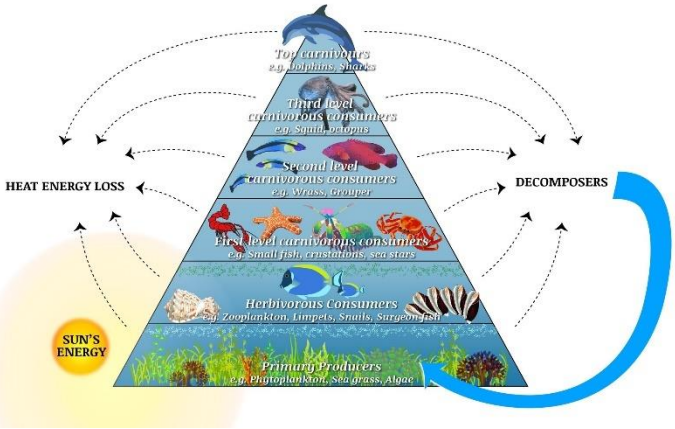


Figure 12: Trophic levels in coral reef ecosystems (Blue Corner Marine Conservation, n.d.)

Recognising this mutual dependency, RoffaReefs focuses on strengthening reef fish populations as a key strategy to enhance coral reef resilience. However, one of the main challenges in doing so, is a significant knowledge gap in the reproductive biology of marine fish. While coral spawning is increasingly well-documented, reproductive patterns and behaviours of reef-associated fish species remain poorly understood (RoffaReefs, 2025).

To address this, RoffaReefs aims to develop a spawning calendar for marine fish, by identifying the time of spawning and location of spawning grounds. These efforts are guided by natural environmental cues such as lunar cycles, tides, temperature, and seasonal changes. This knowledge can inform both breeding efforts as well as help shape and enhance sustainable fishery policies, ensuring that fish harvesting does not interfere with critical reproductive periods (RoffaReefs, 2025).

In practical terms, RoffaReefs has developed a floating, solar-powered fish breeding system (Figure 13) that allows for the *in situ* development of fish larvae in the marine environment. By placing the breeding system directly in the ocean rather than in artificial aquaria, it not only avoids the technical challenges of replicating complex marine conditions but also addresses the current lack of knowledge about which specific environmental factors are essential for successful egg hatching and larval development. RoffaReefs' nature-based breeding system provides a sheltered, semi-enclosed space where fish eggs (including those of endangered species) can safely hatch and larvae can develop, protected from predation and significantly increasing their chances of survival (RoffaReefs, 2025). Additionally, the innovative system enables studies of fish reproductive behaviour within their natural habitat.

With this floating fish breeding system, RoffaReefs aims to advance effective reef ecosystem conservation by closing critical knowledge gaps in fish reproduction and larval development. This enables the targeted reintroduction of ecologically important fish species into degraded reef environments, strengthening natural fish populations and supporting coral reef restoration efforts. In the longer term, the floating breeding system is also intended to be adapted for coral cultivation, allowing for the integrated recovery of both fish and coral populations as part of a holistic approach to the restoration of entire reef ecosystems, rather than focusing on species conservation.

Alongside improving breeding success under natural conditions, the system helps retain larvae near the reef, which is crucial for local population recovery. A pilot research study with this floating fish breeding system is currently being conducted on Bonaire, and initial trials with species such as blennies and parrotfish have yielded promising results (RoffaReefs, 2025). Notably, RoffaReefs was the first to ever document the live hatching of a fish egg (RoffaReefs, personal communication, 2024).

Figure 13: RoffaReefs' floating fish breeding system at the Sand Dollar site, Bonaire.

This innovative approach seeks to close a crucial gap in reef restoration strategies, where coral replanting is often prioritised, but the role of fish populations in ecosystem recovery receives far less attention. By ensuring the survival of fish species essential to reef health, RoffaReefs addresses a critical weakness in current conservation efforts. Healthy fish populations in turn promote coral resilience, creating a positive feedback loop that benefits the entire coral reef ecosystem. RoffaReefs' work integrates ecological theory, technical innovation, and applied conservation (RoffaReefs, 2025).

4.1.4 RoffaReefs' strategic Three-Pillar Approach: an integrated model for inclusive reef restoration

RoffaReefs has developed a unique strategic framework known as the Three-Pillar Approach, designed to guide their work in fish-based coral reef restoration (RoffaReefs, 2025). With this strategic approach, the programme aims to achieve and operationalise its conservation goals in a socially inclusive and ecologically effective way. This approach integrates Nature, Science, and Local (communities) into one interconnected model, ensuring that RoffaReefs' nature conservation efforts are simultaneously scientifically grounded, ecologically effective, and socially inclusive. It was specifically developed in response to the recognition that existing conservation strategies, next to the ecological role of reef fish, also often overlook the knowledge of local stakeholders (RoffaReefs, 2025).

- **Nature-based pillar:** focuses on implementing nature conservation practices that mimic or complement natural processes, particularly in the context of RoffaReefs' floating fish breeding system, promoting sustainable and regenerative ecosystem management approaches.
- **Science-based pillar:** focuses on advancing understanding ecological systems, biodiversity, and environmental dynamics through rigorous research and data-driven methodologies.

- **Local-based pillar:** emphasises the active involvement of local communities, integrating their needs, knowledge, and aspirations. It seeks to ensure that nature conservation efforts are relevant, culturally appropriate, and supported by those living in and around the conservation area, thereby fostering long-term adoption and sustainability.

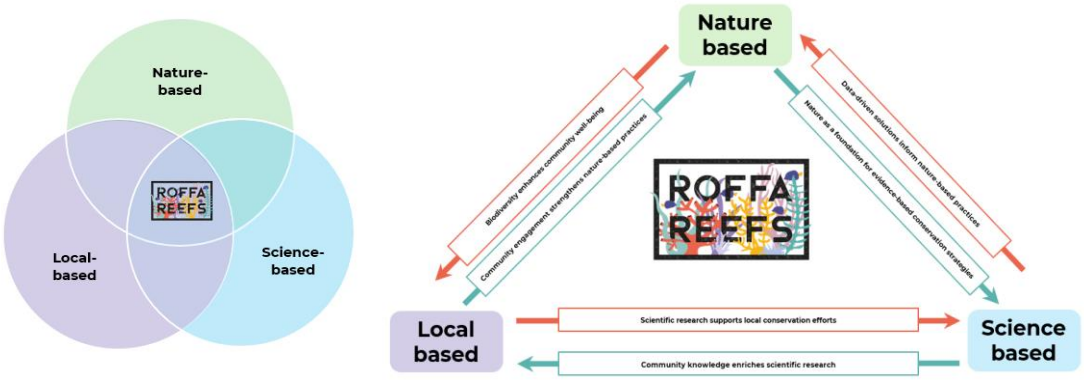


Figure 14: RoffaReefs' three pillar approach and the relationships between its pillars

RoffaReefs' three pillars are interconnected and mutually reinforcing, providing a comprehensive approach to nature conservation that is both scientifically rigorous and culturally sensitive. This integrated approach is designed to achieve sustainable and effective ecological outcomes while fostering community ownership and support. The relationships between the three pillars are illustrated in Figure 14.

4.1.5 Key partnerships and stakeholder dynamics

Although the programme was initiated at Rotterdam Zoo, RoffaReefs now operates as a multi-partner initiative involving both local and international organisations, ensuring a comprehensive community-driven approach to coral reef conservation (RoffaReefs, 2025). Key partners include World Wide Fund Dutch Caribbean (WWF-NL), Dutch Caribbean Nature Alliance (DCNA), Burgers' Zoo, HKV Lijn in Water, Port of Rotterdam, the Technical University of Delft, and the University of Gent. On Bonaire, core partnerships with the fishing cooperative Piskabon, STINAPA, and Dive Friends Bonaire ensure that local expertise and practices, as well as community participation, are fully integrated into the programme's nature conservation strategy (RoffaReefs, 2025).

The stakeholder landscape reveals important dynamics around shared ownership and collaboration. The relationship with Piskabon and STINAPA exemplifies RoffaReefs' local-based approach, where intellectual exchange and knowledge sharing creates a sense of co-ownership that enables local partners to independently advocate for and expand RoffaReefs' vision within their networks. Through its collaborative approach that integrates scientific research, local expertise, and active community participation, RoffaReefs exemplifies a leading model for sustainable marine conservation efforts in the Caribbean, contributing to the long-term sustainability of coral reef ecosystems.

Key take-aways

- *The RoffaReefs programme under Rotterdam Zoo demonstrates zoo-led in situ nature conservation by addressing critical knowledge gaps in reef fish reproduction, moving beyond traditional coral planting approaches to strengthen and restore entire coral reef ecosystems*
- *RoffaReefs Three-Pillar Approach integrates nature-based, science-based, and local-based solutions, demonstrating that effective nature conservation requires combining all three approaches rather than relying on any single method*

4.2 Stakeholder interview research on Bonaire: methodology

Research context and objectives

This research was conducted to support Rotterdam Zoo in exploring how they might define and position their role in relation to nature conservation efforts. By learning from the experiences and perceptions surrounding RoffaReefs, Rotterdam Zoo can gain insights into effective strategies for their own nature conservation decisions. The primary objective was to explore how stakeholders on Bonaire perceive various aspects or nature conservation, specifically focusing on:

- Stakeholder perspectives on important factors in nature conservation
- Success factors for nature conservation initiatives such as RoffaReefs
- Whether local community engagement correlates with positive impacts on nature conservation
- Important factors in collaboration among stakeholders in nature conservation

Research approach

The study employed a mixed methods approach, combining Q-sort methodology with a grid exercise, semi-structured in-depth interviews, and follow-up questioning. Q-sort is a structured research technique that enables qualitative perspectives to be systematically analysed through quantitative methods. Participants rank a set of statements according to their level of agreement using a forced distribution grid that requires prioritisation of choices, allowing for the systematic identification of shared viewpoints. These Q-sort statements (‘*Q-set*’) were developed through literature review, stakeholder consultations, and prior research on Rotterdam Zoo, aligned with RoffaReefs’ three-pillar approach (local, science, nature). The statements were then validated by representatives from RoffaReefs, Rotterdam Zoo, TU Delft, and local experts on Bonaire to ensure cultural sensitivity and contextual relevance. Subsequently, a trial of the complete interview protocol was conducted with a local expert to ensure the clarity and applicability of both the Q-sort exercises and grid exercise in practice. Latent interviewing techniques were used during this process to explore underlying views and motivations, while probing questions encouraged participants to elaborate on their perspectives (see Appendix C for a detailed description of these techniques).

Data were collected through in-person interviews conducted in November 2024 on Bonaire with 15 individuals representing 12 different organisations. These ranged from direct and indirect stakeholders of Rotterdam Zoo and RoffaReefs to organisations with varying degrees of involvement in nature conservation on Bonaire. Participants represented NGOs, commercial enterprises, an environmental consultancy group, a fisheries cooperative, and a volunteer-based foundation (see Figure 15). The diversity of these organisations ensures a broad and representative range of perspectives on the topics in this study. The research consisted of four main components:

- **Q-sort 1:** Important factors for successful nature conservation
- **Q-sort 2:** Important factors for success of nature conservation initiatives such as RoffaReefs
- **Grid exercise:** Organisational mapping examining the relationship between community engagement and positive nature conservation impact
- **Q-sort 3:** Important factors in successful collaborations

The grid exercise involved participants positioning logos of Bonaire-based organisations with direct or indirect relationships to nature conservation on a visual grid. Q-sort 3 was included recognising that successful nature conservation depends on effective collaborations, both within and between organisations, reflecting the importance of the local pillar in RoffaReefs’ approach.

Consecutively, data analysis consisted of quantitative factor analysis to identify shared perspectives, followed by qualitative interpretation of resulting profiles. In addition, thematic analysis of interview recordings was conducted to capture contextual details, nuance, and insights beyond the structured Q-sort results. Detailed methodology, including Q-sort procedures, and analytical methods, are provided in Appendix C.

Figure 15: Organisational overview of interview participants on Bonaire

4.3 Key research findings

The research revealed three critical insights that fundamentally challenge conventional approaches to nature conservation practice and partnership development.

4.3.1 Finding 1: Include the human ecosystem as foundation for successful nature conservation

The research demonstrated that effective nature conservation requires systematic integration of both natural and human ecosystems rather than focusing exclusively on biological or technical interventions. RoffaReefs' conservation impact stems from its recognition that sustainable outcomes depend simultaneously on scientific understanding, technological innovation, social legitimacy, cultural appropriateness, and economic viability.

4.3.1.1 Social-dynamics impact nature conservation effectiveness

Across all interviews and Q-sorts, stakeholders consistently emphasised that effective nature conservation fundamentally depends on the quality of human relationships and personal connections. On a small island such as Bonaire, trust operates through deeply personal networks, information flows via face-to-face contact and local communication channels, and organisational reputations are rapidly established and disseminated. The research demonstrated that nature conservation projects which overlooked these social dynamics risk losing legitimacy regardless of their technical quality, while those that invest in authentic relationship building gained access to local knowledge networks and secured long-term stakeholder support. This finding fundamentally changes nature conservation approaches that prioritise technical or scientific solutions while neglecting the social mechanisms that determine project viability and impact. As one stakeholder observed: *"Everything in life revolves around human connection: that connection must be good, only then we can change together and make impact"*.

Crucially, this insight extends beyond simple networking to recognising that humans are integral parts of the ecosystem, not separate from it. Nature conservation operates within socio-ecological ecosystems where human behaviour, values, and relationships directly determine nature conservation outcomes. As one stakeholder emphasised: *"Nature conservation projects cannot succeed regardless of their scientific quality when local communities do not see themselves reflected in these conservation efforts or find their relevance to their daily lives, such as continuing to capture sharks despite species protection efforts"*. However, it is important to note that this is not because local communities would fail to understand conservation values, but because nature conservation initiatives often fail to connect meaningfully with local contexts, needs, and priorities. Moreover, it is essential to understand the underlying motivations behind behaviours that may seem counterproductive to nature conservation goals. For instance, catching protected sharks in some situations may not stem from disregard for nature, but from the immediate need to feed one's family when no alternative income sources are available. Nature conservation concern can be viewed as a 'luxury' when basic survival needs remain unmet, highlighting that effective nature conservation must address socioeconomic realities alongside ecological objectives. This challenge is compounded by the fact that nature conservation initiatives often rely on volunteer-based engagement approaches, which may not be accessible to residents already working multiple jobs to meet basic needs. Additionally, current outreach efforts often take place at locations such as hotels or dive schools that primarily attract non-native residents and tourists, rather than in community spaces where native residents

typically gather. These patterns highlight the need for more inclusive and economically accessible approaches to local community engagement, including creating paid participation opportunities and actively reaching out to communities rather than waiting for them to participate.

4.3.1.2 The socio-ecological approach: integrating human and natural ecosystems

The research shows that successful approaches require moving beyond viewing communities as audiences to be educated, instead creating authentic partnerships that respect local expertise and establish balanced, respectful knowledge exchange. Ultimately, nature conservation falls or stands with people: they constitute the organisations that implement nature conservation work, provide the funding that enables projects, and make daily decisions that either support or undermine conservation goals. By integrating both natural and human ecosystems in a holistic socio-ecological approach, conservation initiatives achieve greater resilience and effectiveness than when operating as purely technical or scientific interventions.

In nature conservation, we tend to focus predominantly on the natural ecosystem and scientific approaches while overlooking the human ecosystem that is equally essential. Conservation science has traditionally separated humans from nature (Figure 16), but this research demonstrates that successful initiatives recognise and address both dimensions as deeply interconnected parts of a single socio-ecological ecosystem (see Figure 17). Without integrating the human dimension, even the most scientifically sound conservation projects struggle to achieve lasting impact.

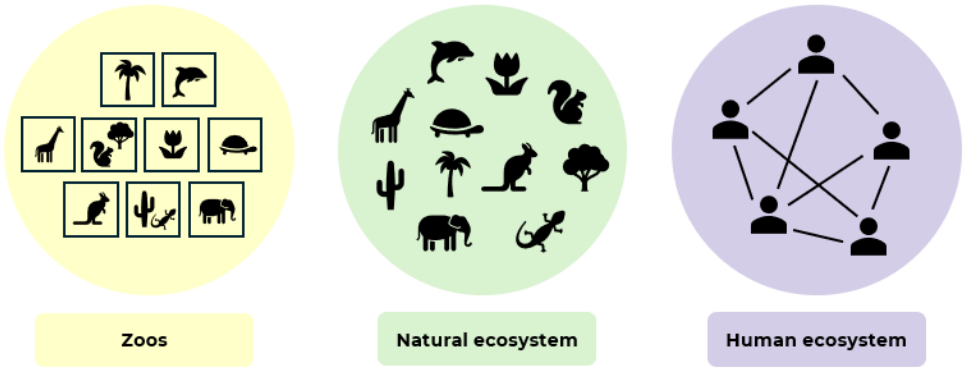


Figure 16: Traditional nature conservation approaches: separate natural and human ecosystems

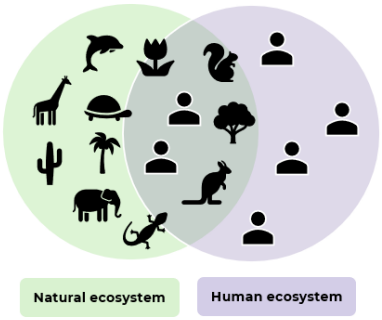


Figure 17: The socio-ecological ecosystem: interconnected natural and human ecosystems.

The socio-ecological approach recognises that human communities and natural ecosystems are fundamentally interconnected, with social dynamics directly influencing environmental outcomes and vice versa, making it impossible to preserve one without addressing the other. This understanding shifts nature conservation from a purely scientific endeavour to a comprehensive social-environmental practice that must address human needs, values, and behaviours alongside ecological restoration and protection goals (see Figure 18).

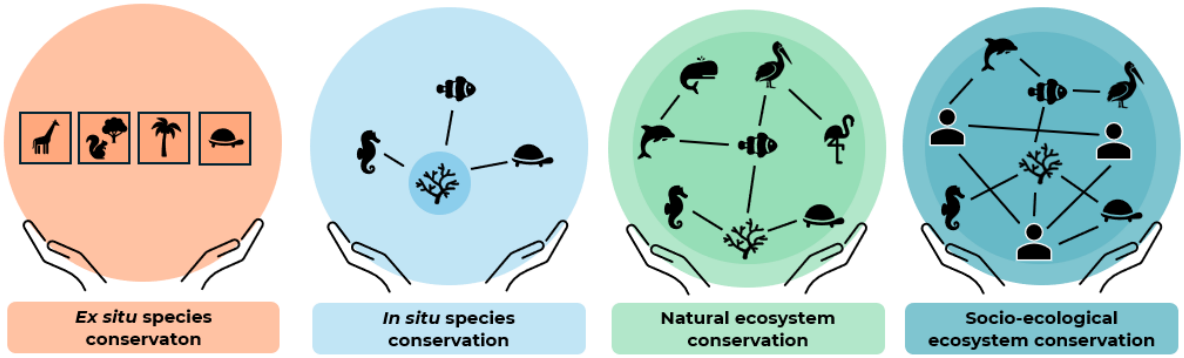


Figure 18: Nature conservation approaches: from species-focused to ecosystem to socio-ecological conservation

4.3.1.3 Local pillar integration transforms communities from audiences to co-owners

The analysis revealed that RoffaReefs' primary differentiating factor lies in its systematic integration of local knowledge and community aspirations into every aspect of programme design and implementation. Rather than adopting a paternalistic approach that positions external organisations as knowledge providers to local communities, the programme creates genuine co-ownership through strategic partnerships such as the collaboration with Piskabon (Bonaire's fishing cooperative). This early integration of local fishers and marine operators acknowledges their expertise and creates balanced, respectful knowledge exchange. This approach generates shared ownership, reducing resistance towards external interventions, and providing access to ecological knowledge that remains unavailable through academic literature while ensuring local partners receive meaningful value in return through an integral and equitable partnership approach.

Furthermore, the research identified three distinct philosophical approaches among stakeholders regarding community involvement:

- **Partnership-Focused Collaborators** (10 organisations) value transparent communication and structured community engagement. They foster collaboration through inclusive processes that integrate scientific evidence with local knowledge, while maintaining a pragmatic approach to conservation outcomes. They recognise the importance of long-term strategies and strategic relationship-building to create sustained conservation impact.
- **Community Knowledge Integrators** (2 organisations) advocate for mandatory community involvement in all decision-making processes. Rather than dismissing science, they prioritise experiential and community-based knowledge alongside scientific approaches. They value 'knowledge democratisation', believing that conservation efforts must integrate local expertise with scientific methods to address complex ecosystem challenges and ensure cultural appropriateness of solutions.
- **Entrepreneurial Ecosystem Strategists** (1 organisation) emphasise proactive leadership and entrepreneurial approaches while focusing on ecosystem-level conservation. They value strategic direction and demonstrated competence in achieving measurable environmental outcomes. While maintaining some distance from community-driven processes, they recognise the importance of societal alignment and collaborate when it advances conservation goals effectively.

Despite different philosophical approaches among stakeholders regarding community involvement (see Appendix C for methodology and detailed analysis of stakeholder philosophies), all acknowledge that active community engagement is crucial for achieving sustainable conservation outcomes.

The natural environment remains central across all perspectives, though expressed differently. Specifically, *Entrepreneurial Ecosystem Strategists* focus on measurable ecosystem improvements, *Community Knowledge Integrators* emphasise the integration of social and ecological wellbeing, and

Partnership-Focused Collaborators seek balanced approaches that accommodate diverse conservation philosophies.

Successful conservation requires speaking the language of diverse stakeholders to create meaningful engagement. While some organisations operate from ideological motivations, others are primarily driven by economic considerations. To unite all stakeholders in conservation efforts, successful initiatives must demonstrate value in terms that resonate with each group's core motivations, whether that is ecological impact, economic benefits, social outcomes, or scientific advancement. Only by bringing together people with diverse motivations can nature conservation achieve the scale and support necessary for meaningful change.

4.3.2 Finding 2: Think in ecosystems, not just species

The research revealed different philosophical approaches to nature conservation targets. Some organisations prioritise species-specific conservation, arguing that focusing on keystone or indicator species provides clearer metrics for success and that the return of certain species indicates ecosystem health. Others advocate for ecosystem-level approaches, maintaining that ecosystems are too complex to fully understand through individual species and that functioning ecosystems are the ultimate goal of conservation. This debate reflects a fundamental tension in nature conservation practice between the measurable outcomes of species-focused work and the holistic but more complex assessment of ecosystem recovery.

This systems perspective challenges traditional zoo-based conservation approaches that emphasise individual species protection, suggesting significantly greater impact potential through habitat restoration and ecosystem recovery projects that address interconnected social-ecological challenges. Ecosystem approaches prove more effective because they address root causes of biodiversity loss rather than treating symptoms, creating lasting impact through interconnected system recovery. The analysis revealed that conservation initiatives achieve greater resilience and effectiveness when they operate as integrated social-ecological systems rather than purely technical interventions.

4.3.3 Finding 3: Build bridges through mutual understanding, clear role definition and communication of boundaries enable effective partnerships

The research revealed that successful nature conservation initiatives require explicit articulation of both organisational capabilities and limitations. Stakeholders consistently emphasised that organisations must communicate not only their intended roles but also establish clear boundaries regarding their responsibilities and capabilities.

The analysis revealed varied perceptions among stakeholders concerning the relationship between RoffaReefs and Rotterdam Zoo. Some associated this connection with enhanced credibility and resource access, while others highlighted the importance of ensuring authentic commitment to promised outcomes and fostering stronger integration within the local Bonaire conservation community. This stresses the need for clear role definition and communicating both capabilities and limits to external stakeholders.

This reflects the complex nature of multi-organisational nature conservation initiatives, such as the triangular relationship between RoffaReefs, Rotterdam Zoo, and WWF Dutch Caribbean (WNF-NL) presents particular complexity, as each organisation contributes differently to the initiative: Rotterdam Zoo provides staff salaries, WNF-NL contributes the majority of operational funding, while Piskabon provides essential local knowledge through intellectual rather than financial support.

The research established that when organisational roles and responsibilities remain ambiguous, stakeholders may develop misaligned expectations regarding contributions and recognition. Conversely, when organisations explicitly define their operational boundaries and resource limitations, complementary partnerships can develop more effectively, allowing partners to identify and address gaps in collective capabilities.

Successful partnerships consistently demonstrated transparent communication regarding organisational roles, capabilities, and operational boundaries, thereby allowing partner organisations to identify and address complementary needs. Furthermore, authentic commitment and demonstrable expertise emerged as significantly more influential than financial incentives in driving effective conservation collaborations. This suggests that long-term conservation partnerships thrive primarily on shared purpose and complementary capabilities rather than transactional relationships.

Collaboration dynamics reveal both systemic tensions and strategic opportunities

Factor analysis identified distinct approaches to nature conservation collaboration that organisations adopt. These range from organisations focused primarily on knowledge exchange and network building to those seeking tangible resources and formal recognition of their contributions. These divergent collaboration philosophies create potential friction around two fundamental operational questions:

- **The Leadership Paradox**: The research identified a fundamental tension regarding leadership in nature conservation partnerships. Some organisations explicitly reject hierarchical structures, preferring flat, consensus-based approaches where all partners have equal input. Others strongly advocate for clear leadership to provide direction and accountability. This disagreement creates practical challenges in multi-organisational initiatives: when no entity has clear authority to make decisions or coordinate efforts, conservation projects may stall or fragment, yet imposing leadership can alienate partners who value autonomy.
- **The Autonomy-Dependency Balance**: Nature conservation organisations face an inherent tension between maintaining their independent identity and accessing needed resources through deeper integration with partners. The research revealed organisations at both ends of this spectrum: those willing to adapt their operations and identity to gain access to financial support, expertise, or infrastructure, and those that carefully guard their autonomy while engaging only in partnerships that respect their independence. This creates collaboration challenges when organisations with different perspectives must work together on shared conservation goals.

Despite these tensions, the research identified knowledge sharing as a universal currency for collaboration, with all stakeholder groups demonstrating strong preferences for learning and insight exchange. Recognition of contributions and transparent acknowledgement also emerged as cross-cutting motivational factors that can bridge otherwise incompatible partnership philosophies.

An important dimension that emerged concerns economic perspectives in nature conservation partnerships. While ideologically-driven organisations focus primarily on ecological outcomes, pragmatic stakeholders noted that successful conservation often requires engaging economically-motivated actors by demonstrating the financial benefits of nature conservation. As one leadership representative observed, not every organisation is ideologically aligned with nature conservation values, and some are primarily driven by financial considerations. To engage these actors effectively, nature conservation initiatives must articulate economic benefits and return on investment, speaking their language rather than expecting them to adopt nature conservation-focused motivations.

These findings suggest that flexible partnership models, rather than standardised collaborative agreements, prove essential for accommodating diverse organisational preferences while achieving collective conservation objectives.

Key takeaways

- *Nature conservation success requires including the human ecosystem alongside natural ecosystems, as social relationships and community dynamics determine project outcomes regardless of technical merit*
- *Ecosystem-level thinking proves more effective than species-focused approaches because natural systems are interconnected, requiring socio-ecological solutions that address both environmental and social dimensions*
- *Successful partnerships depend on clear communication of organisational capabilities and limitations to enable complementary collaboration*
- *Local engagement must shift from education towards genuine co-ownership and balanced knowledge exchange rather than one-way extraction*

4.4 Conclusion: What we learned: nature conservation as social-ecological system design

The RoffaReefs case study and interview research reveal that nature conservation success requires designing *socio-ecological ecosystems* rather than focusing solely on implementing purely technical interventions. Effective nature conservation must simultaneously address natural processes, scientific understanding, and human social dynamics. This suggests opportunities to enhance the effectiveness of nature conservation initiatives beyond technical knowledge and financial resources: by strengthening social engagement and community involvement, developing partnerships with deeper organisational commitment and shared ownership, and aligning institutional goals with realistic operational capacities that enable sustainable progress. The research demonstrates that nature conservation effectiveness depends on successfully integrating natural, scientific, and social systems; organisations cannot succeed in one dimension while neglecting others. This finding fundamentally challenges traditional nature conservation approaches that prioritise technical solutions while treating social elements as secondary considerations.

The research establishes that authentic conservation requires three integrated capabilities: technical expertise in ecosystem restoration, genuine partnership development with local stakeholders, and strategic organisational positioning that aligns commitments with capabilities. RoffaReefs succeeds precisely because it operates coherently across all three dimensions, creating a model where scientific innovation, community co-ownership, and institutional authenticity reinforce each other systematically.

5

Summary Chapter 5: This chapter synthesises insights from the RoffaReefs case study to understand implications for zoo-led nature conservation. Analysis of RoffaReefs' Three-Pillar Approach identifies three areas for zoo consideration: integrating human and natural ecosystems through stakeholder engagement, balancing species-focused and ecosystem-level conservation approaches, and developing partnerships with clear organisational communication. The research reveals that nature conservation involves sustained engagement and multi-stakeholder collaboration across different organisational contexts. The analysis explores implementation considerations for zoos pursuing conservation transformation, examining how organisations navigate diverse stakeholder expectations and operational constraints. Findings indicate a gap between conservation aspirations and operational implementation, suggesting potential value in systematic frameworks for evaluating organisational trade-offs. The chapter concludes with a design brief for a decision-support tool that enables zoo employees to explore nature conservation scenarios and examine their operational implications, supporting strategic decision-making about institutional direction.

H5 Synthesis: translating the nature conservation insights from Bonaire into strategic lessons for zoos

The RoffaReefs case study on Bonaire provides valuable insights into how zoos can contribute meaningfully to ecosystem restoration beyond their traditional boundaries. This chapter synthesises these findings and translates them into strategic lessons for zoo-led nature conservation.

5.1 Research implications for zoos: three strategic imperatives

The key findings of the RoffaReefs case study provide respective strategic insights for Diergaarde Blijdorp's positioning in nature conservation:

5.1.1 Finding 1: Include the human ecosystem as foundation for successful nature conservation

The research established that RoffaReefs' three-pillar approach contributes to nature conservation success by systematically integrating nature-based, science-based, and local-based solutions. Applying this framework to evaluate Rotterdam Zoo's current nature conservation approach reveals that the local-based pillar represents an underdeveloped strategic opportunity.

Currently, for Rotterdam Zoo, the local-based pillar is only reflected in its visitor operational pillar. Notably, Rotterdam Zoo employees are not included in any of the zoo's operational pillars, despite their essential role in the zoo's operations. They too must be included in the transition through participatory transformation as explained in Chapter 4. The research on Bonaire underscored that successful nature conservation requires everyone to be included and conservation principles to be implemented across all operations. This means creating genuine co-ownership of nature conservation goals where transformation is actively embraced and implemented by staff throughout the organisation rather than attempting change through top-down missions alone.

The local pillar also requires rethinking external engagement. Moving beyond a visitor-centric model, Rotterdam Zoo could engage audiences as active participants in nature conservation, leveraging their knowledge and commitment rather than treating them solely as beneficiaries of education. For the local pillar to be successfully integrated into the zoo's operations, this means focusing on all stakeholders, from employees and visitors to city residents and policymakers, to become partners in the zoo's nature conservation mission rather than audiences, emphasising the 'together' in "*together we bring nature back to life*".

Next to that, the research on Bonaire stresses the importance of long-term commitment, local presence, sustained engagement, and authentic relationships. This insight fundamentally challenges project-based nature conservation approaches, suggesting value in developing multi-year conservation commitments with consistent staffing, relationship building, and genuine community integration rather than temporary interventions or superficial stakeholder management. The research revealed that building trust and credibility requires sustained presence over several years, as short-term initiatives tend to face acceptance barriers. Such partnerships must be two-way, not only receiving knowledge or resources but also giving back to back to local communities with whom you collaborate and ecosystems in which you operate. Hiring local people gives the opportunity to truly integrate local knowledge into operations and simultaneously give back to the community by making nature conservation work more economically accessible to all demographics.

Additionally, while many nature conservation organisations express commitment to local employment, they often cite challenges in practical implementation related to different work approaches and expectations. This highlights the need for thoughtful integration strategies that acknowledge diverse working styles while creating meaningful local employment opportunities that enable nature conservation broader community participation in nature conservation.

5.1.2 Finding 2: Think in ecosystems, not just species

Applying RoffaReefs' approach reveals that while the nature-based pillar is represented through Masterplan 2050's four guiding principles and the sustainability operational pillar, and science has its own operational pillar, there are opportunities for deeper integration. This analysis reveals that while Rotterdam Zoo demonstrates strength in the science-based pillar through research and breeding programmes, current scientific efforts focus primarily on individual species knowledge rather than researching how entire ecosystems function and interconnect. For the zoo to truly research ecosystem dynamics, exhibits would need to be redesigned to represent complete ecosystems and natural habitats rather than housing single species separately as discussed in Chapter 2, enabling study of how different species interact within shared environmental conditions.

While Rotterdam Zoo contributes to breeding programmes and works towards making their operations more sustainable, the nature-based pillar requires more active engagement with natural processes themselves. This involves learning from ecosystem dynamics and natural processes and applying these insights to species management and nature conservation practices. Currently, one of the few examples of this ecosystem approach within Rotterdam Zoo is the reef in the Oceanium, where everything interconnects and coexists under shared environmental conditions, creating opportunities to study how natural processes function within complete ecosystems.

Traditional zoo approaches focus on individual species, yet RoffaReefs' emphasis on ecosystem-level nature conservation suggests value in expanding beyond impact species as the major focus towards habitat restoration and ecosystem recovery projects that address interconnected social-ecological challenges as the goal for 2050. While Rotterdam Zoo presents its impact species as ambassadors for broader ecosystems, operationally focusing more on complete ecosystems could enhance nature conservation effectiveness. This creates both opportunities and communication challenges: while individual species may be important for public connection and recognition, the zoo must balance this with clearly communicating its broader ecosystem-level impact to avoid the perception that it only engages in species-focused conservation rather than comprehensive ecosystem restoration.

Currently, within the Rotterdam Zoo, the three pillars from RoffaReefs' approach function relatively independently, yet RoffaReefs demonstrates that the three pillars can be much more mutually reinforcing. By adopting this integrated approach throughout the zoo's operations, the organisation could amplify its conservation impact and operationalise ecosystem-level thinking within its own organisational structure. This creates opportunities for Rotterdam Zoo to develop more zoo-led *in situ* nature conservation initiatives, more directly embodying the interconnected conservation approach that RoffaReefs exemplifies beyond the zoos boundaries.

5.1.3 Finding 3: Build bridges through mutual understanding, clear role definition and communication of boundaries enable effective partnerships

The research revealed that successful nature conservation requires genuine collaboration rather than branded initiatives. This has profound implications for how zoos position themselves in nature conservation partnerships, emphasising shared ownership over institutional recognition while ensuring that commitments align rigorously with demonstrated capabilities. Stakeholders consistently emphasised that organisations must articulate not only their intended contributions but also explicit limitations and non-responsibilities. Acknowledging these boundaries enables complementary partnerships to develop while preventing unrealistic expectations that can undermine collaborative effectiveness.

The concept of being an *'inside outsider'* emerged as optimal for effective conservation engagement. This represents someone external who demonstrates genuine long-term commitment to community benefit while valuing and respecting local knowledge and expertise. The external position allows for neutral collaboration across different stakeholder groups. The inside element, showing sustained local engagement and investment in community wellbeing, builds the trust necessary for successful collaboration. Establishing this position requires explicit commitments to knowledge sharing and mutual benefit rather than one-way extraction. For zoos engaging in international nature conservation, this means recognising their role as supporters rather than leaders, understanding and acknowledging their own limitations, and avoiding paternalistic approaches that impose external solutions. Success requires moving beyond short-term project funding toward sustained multi-year commitments with consistent staffing while explicitly communicating what the zoo can and cannot contribute to local conservation efforts. These insights reinforce the fundamental role of clear and transparent communication in effective nature conservation partnerships, a theme explored throughout Chapter 4. Additional context on the Bonaire research setting, practical implementation considerations, and stakeholder dynamics are provided in Appendix B.

Key takeaways

- *Zoos must include the human ecosystem in nature conservation by engaging all stakeholders as active partners rather than audiences, requiring sustained local presence and authentic long-term relationship building rather than project-based interventions*
- *Zoos should shift from species-focused to ecosystem-level approaches by integrating RoffaReefs' Three-Pillar Approach across all operations, enabling mutually reinforcing nature conservation impact rather than isolated initiatives*
- *Successful nature conservation partnerships require zoos to communicate both capabilities and limitations clearly, enabling genuine collaboration through shared ownerships while avoiding paternalistic approaches*
- *Zoo cannot meet all expectations equally if they are to transform meaningfully, requiring strategic prioritisation and transparent communication with staff and stakeholders about institutional direction*

5.2 Conclusion - From insights to action: the challenge ahead

For Rotterdam Zoo, these research findings suggest that nature conservation transformation requires systematically aligning their nature conservation goals, operational capabilities, and stakeholder relationships rather than sequential improvements to individual organisational dimensions. The organisation cannot achieve genuine nature conservation impact through good intentions or scientific research alone, nor through improved stakeholder engagement without corresponding changes to institutional positioning and resource allocation. Success demands consistency across all organisational activities, from species collection strategy to financial architecture to partnership development.

The RoffaReefs case study reinforces a core insight from Chapter 4: while Rotterdam Zoo has committed to becoming a nature restoration organisation, the operational consequences of this strategic choice remain to be fully defined. The case study reveals that nature conservation success depends on making difficult choices about what an organisation will and will not do. RoffaReefs demonstrates what focused nature conservation can achieve when operating with defined expertise, focused partnerships, and authentic commitment to specific outcomes. Rotterdam Zoo can learn from this focused approach as it navigates its broader institutional scope, which currently maintains broad collections of over 200 animal species, diverse revenue streams, and multiple stakeholder relationships. The question becomes how the organisation can apply RoffaReefs' focused approach principles across its wider operations to achieve similar nature conservation impact at institutional scale.

These insights extend beyond Rotterdam Zoo to the broader zoo sector facing similar transformation challenges. This complexity stems from the interconnected nature of institutional transformation: seemingly isolated decisions about individual aspects actually affect all operational dimensions.

Successfully navigating this transformation requires developing robust decision-making processes that can evaluate trade-offs, provide insight into operational consequences across different organisational dimensions, and maintain strategic coherence while adapting to changing circumstances. Moving forward necessitates strategic decisions about which visitor segments to prioritise and how to balance short-term financial realities with long-term nature conservation goals, as organisations cannot meet all expectations equally while achieving meaningful transformation. This creates a critical need for systematic decision-making tools that can help zoos navigate the complex choices and trade-offs inherent in genuine conservation transformation. The RoffaReefs model provides zoos with a framework for evaluating conservation positioning: authentic nature conservation requires demonstrably integrating nature-based practices, science-based research, and local-based community engagement, with organisational decisions consistently reflecting this integrated approach rather than maintaining traditional zoo operations alongside aspirational conservation messaging.

However, translating these lessons into zoos' institutional context requires confronting fundamental questions about organisational identity, resource allocation, and operational priorities that remain unresolved. The following section outlines the design brief for a decision-support tool that can facilitate zoos to systematically evaluate these complex transformation choices, thereby achieving the strategic coherence that effective nature conservation requires.

5.3 Design brief - From vision to reality: strategic decision-support tool for zoo nature conservation transformation and gaining insight into operational consequences

The following section demonstrates how structured decision-making frameworks can support zoo transformation by enabling systematic evaluation of strategic choices and their operational implications."

5.3.1 Design challenge and problem context

External pressures including changing societal expectations, mounting ethical criticisms, and the escalating biodiversity crisis are forcing traditional zoos to fundamentally reconsider their purpose. In response, zoos across the sector have committed to transforming into nature conservation organisations, adopting the One Plan Approach that integrates *in situ* and *ex situ* conservation efforts.

Reflecting broader sector-wide transformation challenges, the analysis of Rotterdam Zoo's transformation reveals a gap between nature conservation ambitions and operational reality. The RoffaReefs case study demonstrates that successful nature conservation requires integrating three foundational pillars: nature-based practices focused on ecosystem-level thinking rather than individual species, science-based research, and local-based community engagement that authentically includes local stakeholders as partners. Furthermore, the research reveals that only by making explicit strategic choices about what an organisation will and will not do can zoos identify capability gaps and develop strategic partnerships to strengthen their nature conservation impact.

This research explores the question: *"How can zoos be enabled to define and position their role in nature conservation and explore different strategic scenarios while gaining insight into their operational and stakeholder implications?"* and highlights a critical implementation gap. While zoos have generally embraced nature conservation missions, the research reveals that this transformation involves complex, interconnected strategic decisions that operate across multiple organisational dimensions simultaneously.

The fundamental challenge lies in translating these missions into coherent organisational strategy across all areas. Specifically, defining and positioning their new role in nature conservation, systematically implementing this throughout all operational practices, and communicating transparently with stakeholders is essential for authentic organisational transformation. This requires making difficult choices about the degree and focus of organisational nature conservation commitment, involving

employees in defining this institutional direction. Zoos cannot satisfy all stakeholder expectations simultaneously, demanding strategic prioritisation and systematic alignment of programme development, communication, and financial structures to ensure consistent implementation of nature conservation goals.

These challenges are exemplified by the need to balance operational costs, cultural heritage responsibilities, and nature conservation goals while maintaining financial viability through visitor engagement. These trade-offs operate across multiple dimensions simultaneously, creating complexity that requires systematic evaluation. Therefore, zoos would benefit from decision-support tools to evaluate these trade-offs and gain insight into their operational consequences to achieve the strategic coherence that effective nature conservation requires.

5.3.2 Design goal

"Design a strategic decision-support tool that enables zoo employees to explore their personal nature conservation perspective and generate insights into different nature conservation scenarios and their operational implications, supporting informed decision-making about defining and positioning zoos' role in nature conservation"

5.3.3 Design requirements

- **Personal perspective exploration:** enable users to understand their individual views on key nature conservation positioning trade-offs, providing insight into their personal nature conservation philosophy.
- **Scenario comparison capability:** present different institutional nature conservation commitment level scenarios with clear operational implications, enabling users to understand what each positioning practically means across all organisational zoo operations.
- **Operational consequence transparency:** reveal how strategic positioning choices affect visitor engagement, stakeholder relationships, financial requirements, partnership opportunities, and operational priorities, demonstrating what the organisation will and will not do under each scenario.
- **Three-pillar nature conservation insight:** show users what different nature conservation scenarios practically involve for science-based activities, nature-based practices, local-based community engagement, and total nature conservation impact.
- **Contextual positioning awareness:** help users understand how their personal nature conservation perspective relates to different institutional scenarios and compare their positioning with other respondents.
- **Data interpretation capability:** enable review and interpretation of collected insights to understand patterns in organisational perspectives on nature conservation positioning across different stakeholder groups.
- **Quick and flexible engagement:** enable completion within 10-30 minutes that can be used individually for personal reflection or collectively in group settings without requiring extensive preparation or facilitation.

6

Summary Chapter 6: This chapter presents the Zoo Nature Conservation Choice Compass, a digital decision-support tool designed to address the strategic positioning challenges facing zoological institutions. The choice compass translates abstract nature conservation ambitions into six concrete operational scenarios representing different levels of institutional commitment (0% to 100% nature conservation focus). Development followed systematic design principles incorporating Theory of Change (ToC) methodology, extensive board game analysis, and insights from Q-sort research on Bonaire demonstrating the value of tangible decision-making tools. The choice compass employs choice-forcing design across four question types, generating personalised results through a spider-web diagram, scenario matching, and scenario comparison analysis. Implementation leverages digital distribution for individual completion and physical workshops for collective discussion of results. The choice compass generates insights into different organisational nature conservation positioning scenarios by illustrating the operational implications of various commitment levels for animal collections, partnerships, funding, and daily operations. This enables organisations to understand the practical implications of strategic choices and facilitates informed discussions about institutional transformation.

H6. The Zoo Nature Conservation Choice Compass

6.1 Target group

The Zoo Nature Conservation Choice Compass is designed for zoo employees who want to gain insight into different nature conservation scenarios for their institution. This includes both decision-makers and other zoo staff across all departments, enabling organisations to understand where they currently stand as an institution and what perspectives exist among their workforce.

By engaging employees at different levels, the tool provides insights into the range of opinions and values present within the organisation regarding nature conservation approaches. After understanding where they stand, organisations can then determine where they want to go and how to get there.

6.2 Overview of the Zoo Nature Conservation Choice Compass

The Zoo Nature Conservation Choice Compass is a digital questionnaire designed for zoos to generate insights into different nature conservation scenarios. The decision-support tool presents six distinct future scenarios for zoos representing different levels of nature conservation commitment, from maintaining current operations to complete transformation into a nature restoration organisation.

For each scenario, the tool shows what this positioning would mean operationally from daily operations to partnerships and organisational structure. Rather than abstract concepts about nature conservation, the tool translates each approach into concrete organisational implications, showing what the organisation will and will not do under each scenario.

6.3 Value and strategic relevance

The decision-support tool provides zoo employees with clarity about different nature conservation positioning options and their operational consequences. Employees can explore scenarios ranging from no nature conservation focus to complete transformation into a nature restoration organisation, understanding what each approach means for zoos' species collection, visitor experience, partnerships, funding, and organisational structure.
The Zoo Nature Conservation Choice Compass addresses the challenges that while many zoos have embraced nature conservation missions, translating these into consistent operational practice across the organisation remains complex and difficult to implement. Research revealed significant gaps between nature conservation aspirations and operational implementation, with the One Plan Approach from Chapter 2 highlighting the need for consistent mission implementation throughout organisational practices.

The tool generates insights by having users answer questions about nature conservation approaches, organisational priorities, and operational trade-offs, presenting results via three screens:

- **Personal nature conservation profile:** individual positioning across five key nature conservation trade-offs (zoo visitor experience, species conservation, ecosystem conservation, local engagement, and science) displayed in a spider-web diagram, with comparison to the average positioning of respondents to date.
- **Scenario matching:** identification of the organisational nature conservation scenario that best aligns with individual responses, including the detailed breakdown of what this positioning means across organisational identity, operations, external relations, and viability factors.
- **Complete scenario comparison:** percentage alignment with all organisational nature conservation scenarios and a detailed comparison table showing how individual responses align with or differ from each scenario across institutional approaches to nature conservation.

This enables zoos to understand their organisational positioning and employee perspectives, clarifying operational implications of different scenarios including what the organisation would implement and what

it would discontinue. The choice compass functions as a communication framework that facilitates structured discussions with internal teams regarding organisational positioning and strategic direction. These insights can subsequently inform discussions with external stakeholders including funding organisations, nature conservation partners, and community groups.

The collected data enables pattern analysis across different employee groups, revealing organisational consensus and dissensus and identifying areas requiring strategic attention. The choice compass offers an accessible approach to organisational transformation and nature conservation positioning through concrete scenarios that can support strategic planning. Developed through research with Rotterdam Zoo, the tool applies to all zoological institutions addressing comparable strategic challenges.

6.4 Functionality and user process

6.4.1 Process overview

The Zoo Nature Conservation Choice Compass presents users with 17 questions covering nature conservation approaches, organisational priorities, operational trade-offs, and demographic information for organisational analysis. Completion takes approximately 10 minutes, with additional time for 10-20 minutes for reviewing detailed results depending on user engagement.

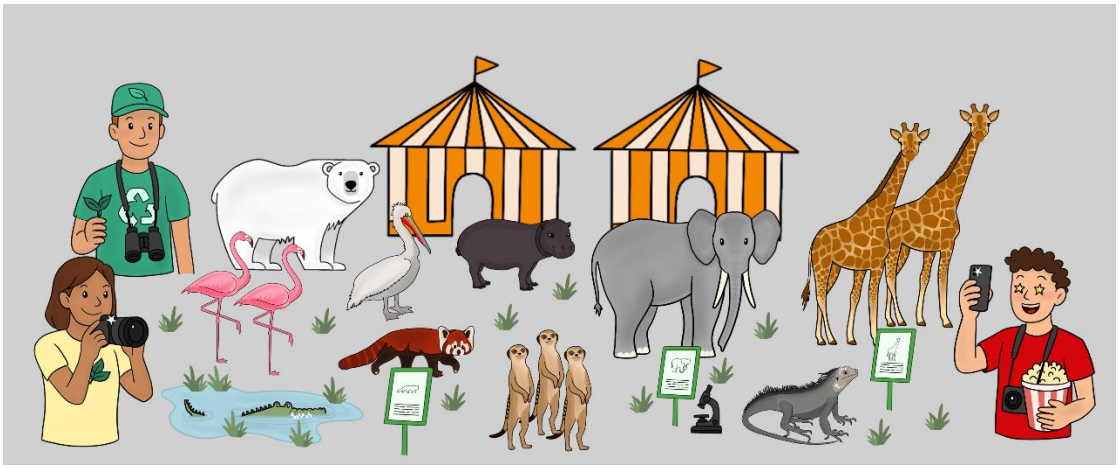
The choice compass employs automated scoring to match responses with nature conservation scenarios and calculates individual positioning across key nature conservation trade-off dimensions. Upon completion, users receive personalised results across three sequential screens: a personal nature conservation profile, scenario matching with operational implications, and a complete scenario comparison analysis.

The choice compass operates with real-time data processing, automatically incorporating responses into running nature conservation profile average. This enables users to compare their personal nature conservation profile with the collective responses from all users to date. All data is automatically stored in Google Sheets, enabling subsequent analysis of response patterns across different respondent groups and operational departments. To try the Zoo Nature Conservation Choice Compass prototype visit the following link: https://zoonatureconservationchoicecompass.netlify.app/.

6.4.2 Six organisational nature conservation scenarios

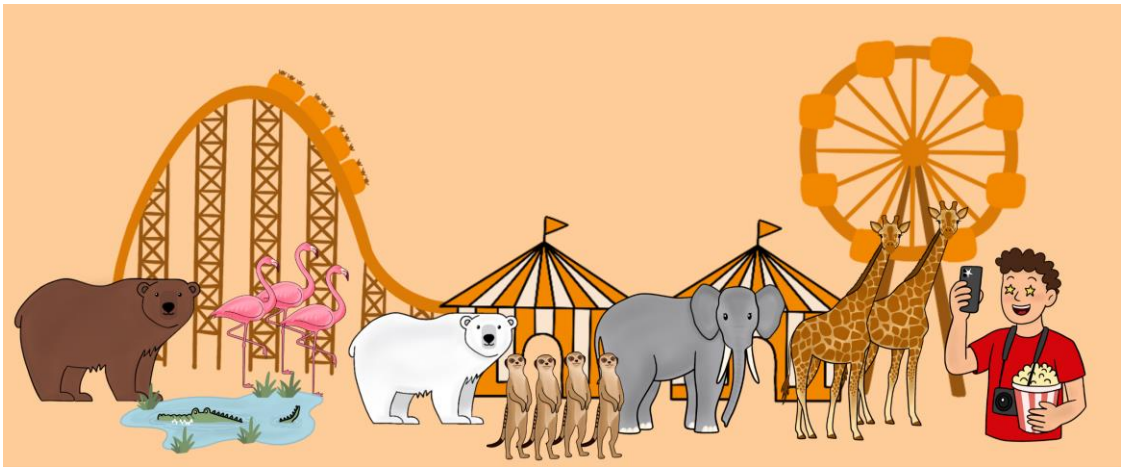
The Zoo Nature Conservation Choice Compass is built around six distinct nature conservation scenarios representing different levels of institutional commitment to nature conservation objectives. The framework uses six scenarios: one representing current operations (Status Quo) and five representing increasing nature conservation commitment levels from 0% to 100% in 25% increments. This covers both extremes while including a balanced 50% scenario.

Status Quo (Traditional zoo with nature conservation elements):



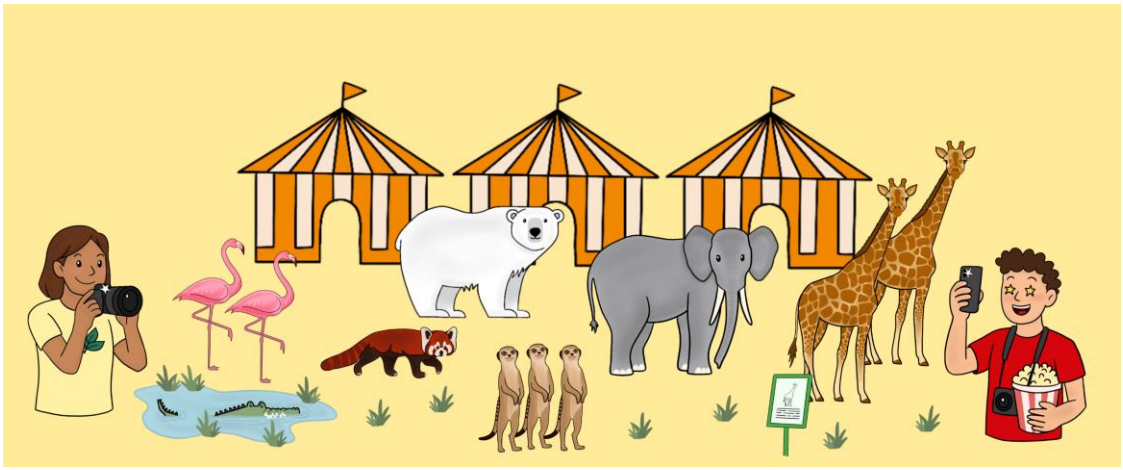
Zoos function as recreational institutions that combine entertainment with nature conservation initiatives. Visitors seek primarily entertainment with growing interest in educational elements. Animal enclosures are predominantly species-specific with limited natural elements. The collection combines popular species for visitor attraction with some threatened species in breeding programmes. Funding relies primarily on ticket and hospitality sales supplemented by a fixed conservation fund. Partnerships encompass commercial companies, some nature organisations and educational institutions. The public image develops from recreational institution towards organisation with societal impact.

0% Nature Conservation Focus (Theme park with animals without nature conservation focus):



Zoos function as wildlife theme parks that offer recreation with nature messaging. Visitors appreciate accessible explanations about animals with growing interest in conservation stories. Animal enclosures remain species-specific but integrate more natural elements and enhanced welfare standards. The collection combines popular species with an increasing proportion of threatened species in breeding programmes. Funding remains ticket-dominant with a growing proportion of sponsors for educational activities. Partnerships encompass commercial companies, incidental involvement of nature organisations and educational institutions. The public image evolves towards 'zoo that also does conservation'.

25% Nature Conservation Focus (Wildlife theme park with nature conservation messaging):



Zoos function as wildlife theme parks that offer recreation with nature messaging. Visitors appreciate accessible explanations about animals with growing interest in conservation stories. Animal enclosures remain species-specific but integrate more natural elements and enhanced welfare standards. The collection combines popular species with an increasing proportion of threatened species in breeding programmes. Funding remains ticket-dominant with a growing proportion of sponsors for educational activities. Partnerships encompass commercial companies, incidental involvement of nature organisations and educational institutions. The public image evolves towards 'zoo that also does conservation'.

50% Nature Conservation Focus (Interactive outdoor nature museum with living species collection):

Zoos function as interactive nature museums that effectively combine recreation and education. Visitors seek interactive programmes and actively participate in educational activities. Animal enclosures combine species-specific spaces with ecosystem-based enclosures where animals can partially retreat. The collection is equally divided between popular species and threatened species in extensive breeding programmes, supplemented with technology. Funding is equally divided between commercial revenues and funds for nature conservation. Partnerships encompass balanced collaboration between commercial companies, nature organisations and educational institutions. The public image is that of innovative institutes that integrate entertainment and nature conservation.

75% Nature Conservation Focus (Living nature restoration laboratory with visitor programmes):

Zoos function as nature restoration laboratories where recreation is supportive to the conservation mission. Visitors seek depth and actively participate in educational programmes. Animal enclosures are predominantly ecosystem-based where animals can freely retreat. The collection consists primarily of threatened species in breeding programmes and temporary care, supplemented with technology that takes over entertainment functions. Funding combines subsidies and donations with limited ticket income. Partnerships encompass intensive collaboration with nature organisations and educational institutions, with limited commercial involvement. The public image is that of leading nature organisations.

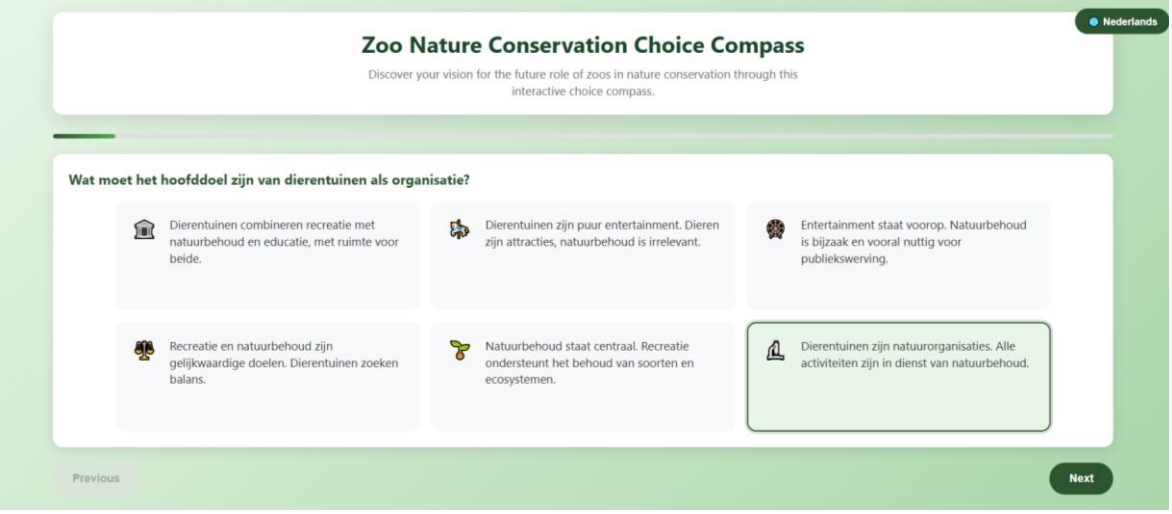
100% Nature Conservation Focus (Research centre for nature restoration open to visitors):

Zoos function as research centres for nature restoration where recreation is entirely subordinate to conservation goals. Visitors actively participate as partners in research and citizen science projects. Animal enclosures are entirely ecosystem-based where animals can completely retreat according to natural behaviour. The collection consists exclusively of threatened species, temporary care and locally relevant species for direct environmental impact. Funding comes primarily from international funds and research subsidies with minimal public income. Partnerships encompass exclusively nature organisations and educational institutions for in situ conservation and research. The public image is that of globally recognised examples for ethical nature conservation.

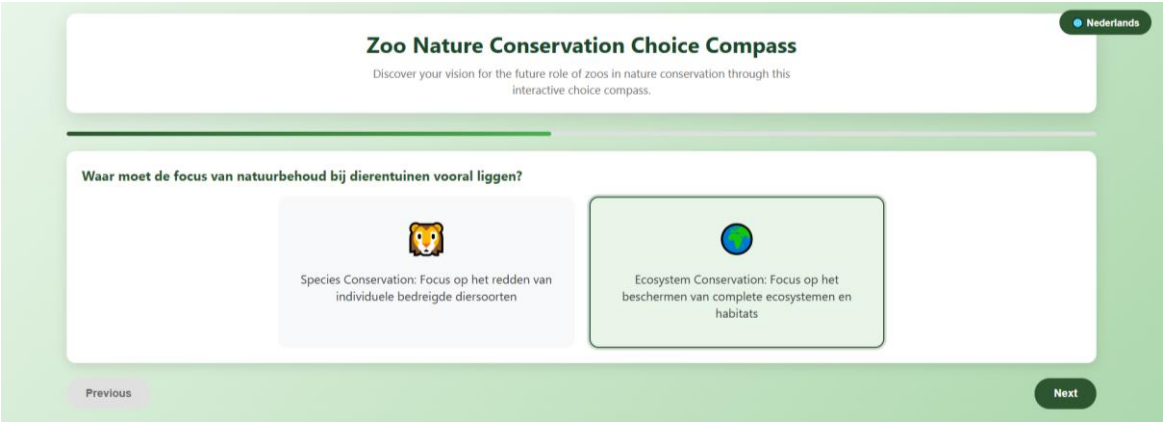
6.4.3 Question design

The Zoo Nature Conservation Choice Compass employs four distinct question types designed to systematically capture respondent preferences across nature conservation positioning scenarios:

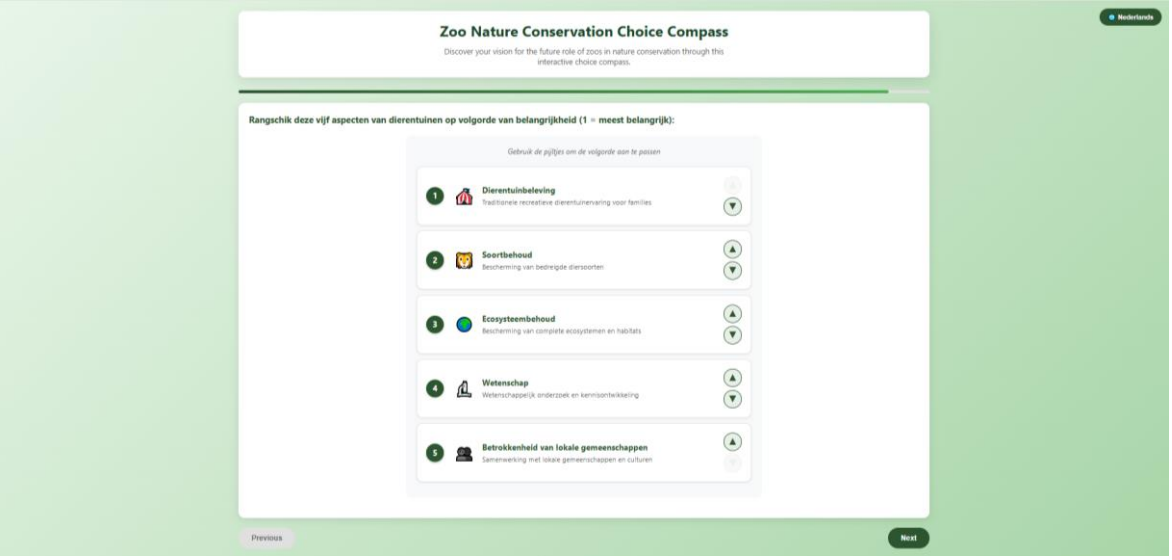
Six-answer questions: each response represents one of the six nature conservation scenarios. Questions address core organisational choices such as primary institutional objectives, ethical positioning, and strategic priorities.



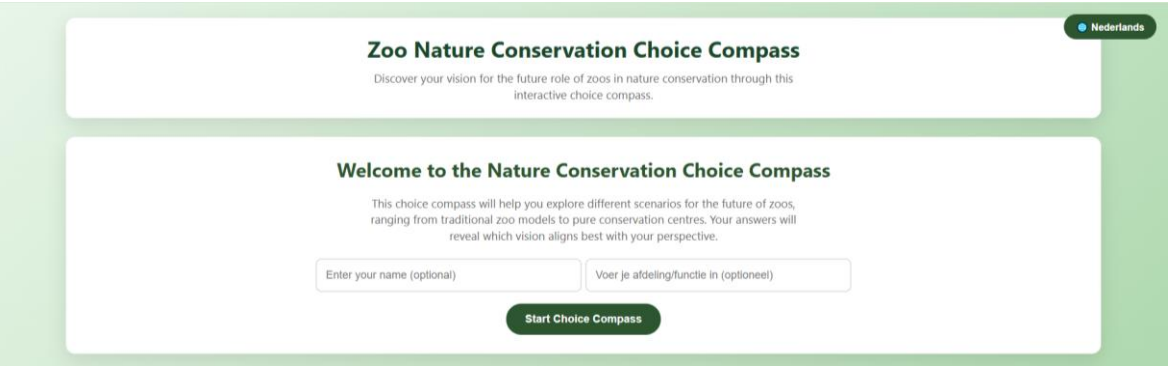
Binary choice questions: present mutually exclusive alternatives requiring users to select between competing nature conservation approaches, such as species conservation versus ecosystem conservation, or animal welfare versus visitor experience. This format directly reflects the fundamental trade-offs inherent in zoo transformation decisions.

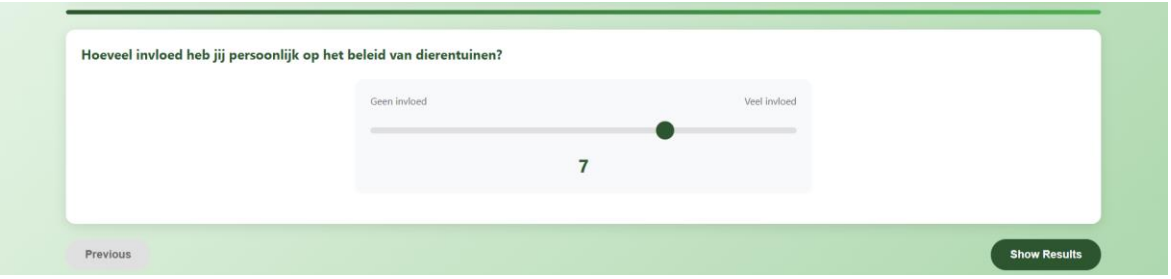


Ranking questions: two distinct ranking exercises establish priority hierarchies. Respondents rank RoffaReefs' three nature conservation pillars (nature-based, science-based, and local-based approaches) and separately rank five operational dimensions (species conservation, ecosystem conservation, science, local engagement, and visitor experience). This reveals individual preference hierarchies in both strategic approach and resource allocation.



Demographic questions: collect organisational context including department affiliation and policy influence levels for subsequent pattern analysis across different respondent groups, enabling organisational insight into perspective distribution.





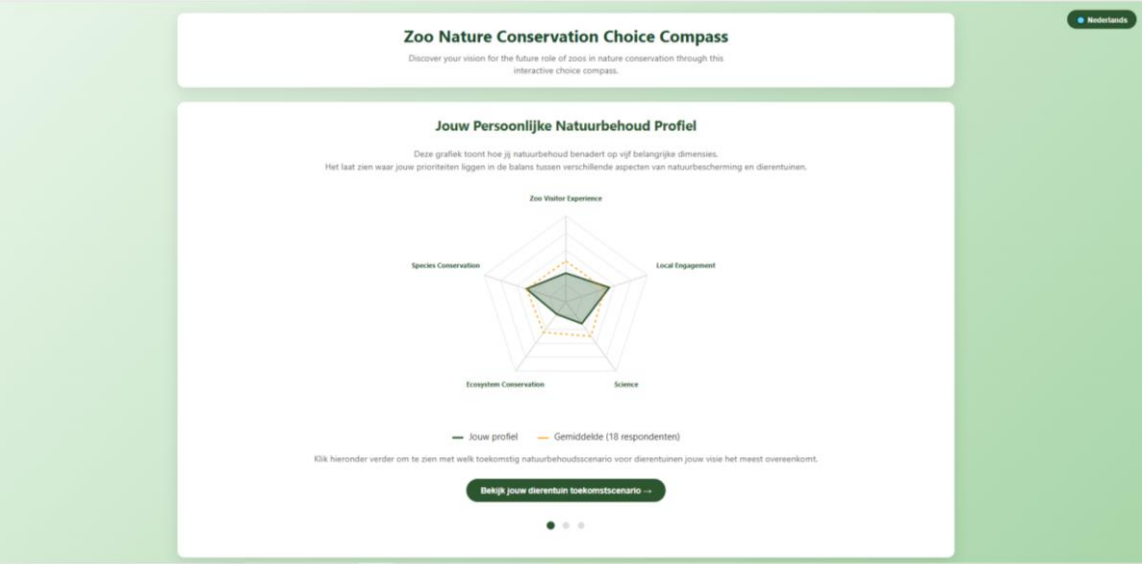
6.4.4 Scoring and results presentation

The Zoo Nature Conservation Choice Compass matches respondents to organisational scenarios based on their response patterns. Nature conservation-focused answers across all question types lead to

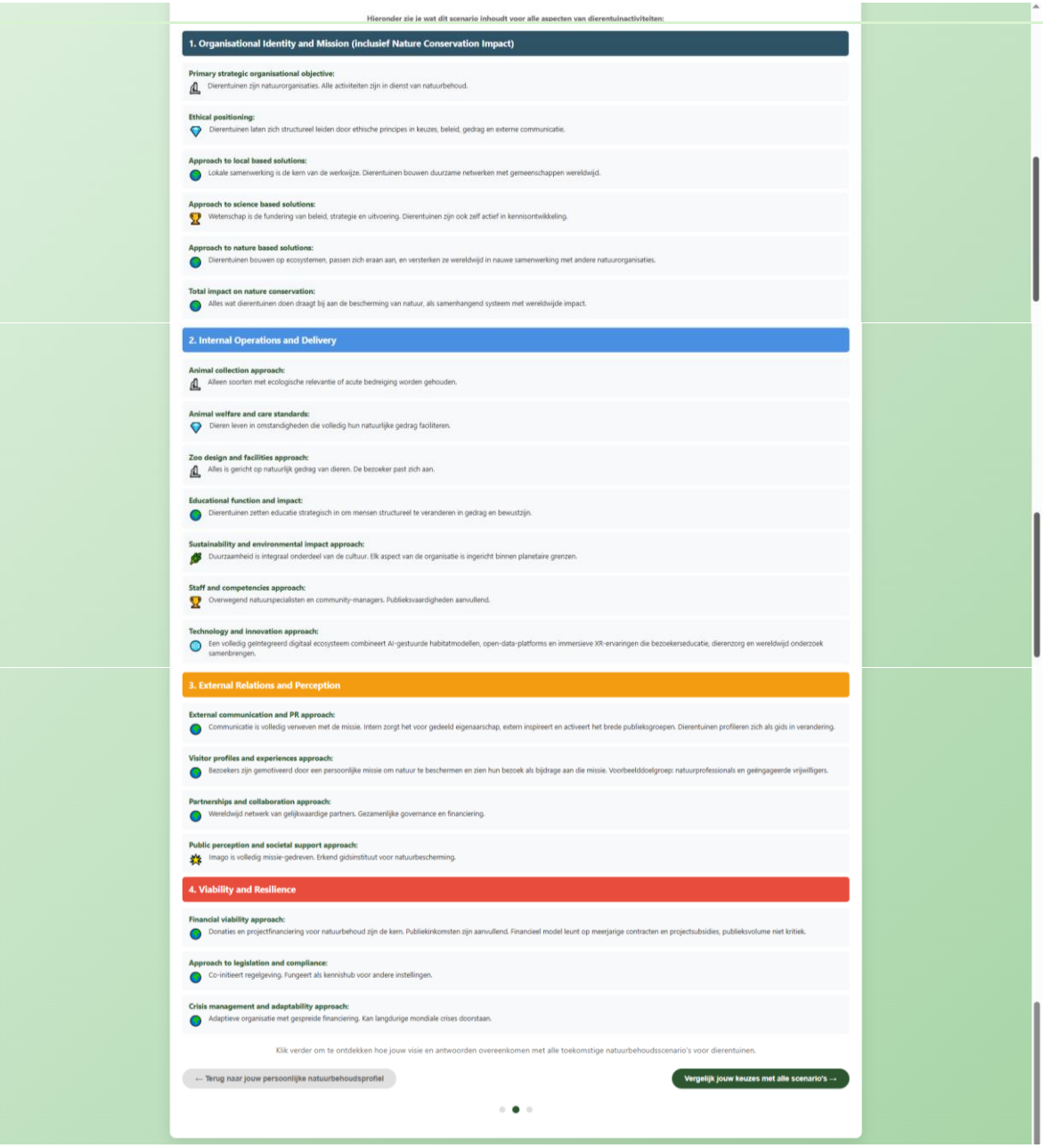
alignment with higher organisational nature conservation scenarios (50%, 75%, 100%), whilse entertainment-focused responses align with lower nature conservation scenarios (Status Quo, 0%, 25%).

The personal nature conservation profile emerges from ranking question responses, mapping individual positioning across the five key dimensions: zoo visitor experience, species conservation, ecosystem conservation, local engagement, and science. These dimensions form the spider-web visualisation that enables comparison with collective user averages. Upon completion, users receive results across three sequential screens:

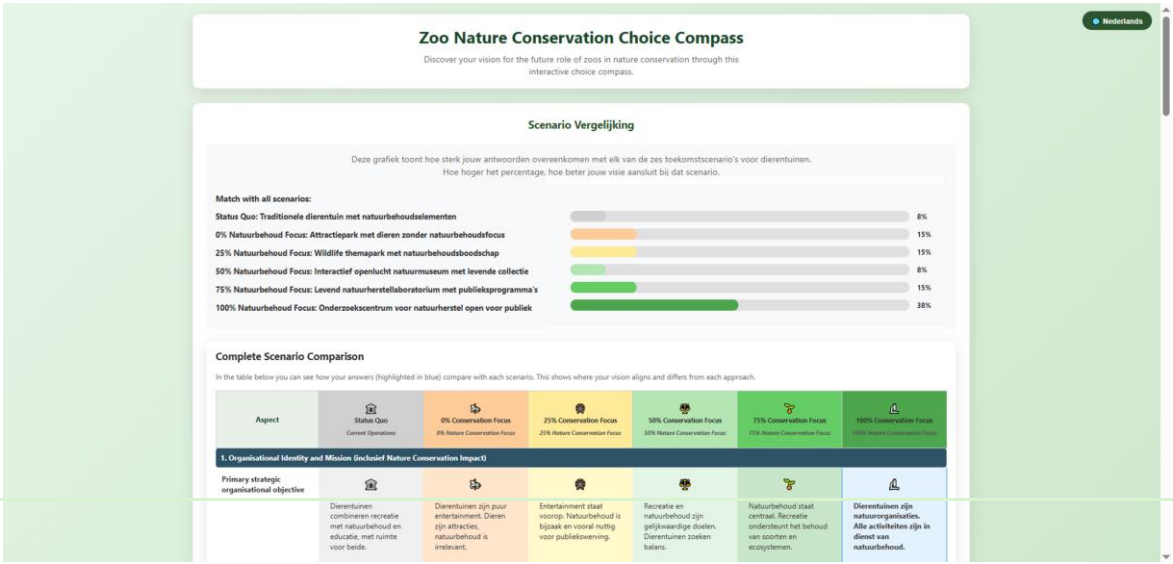
Screen 1 - Personal Conservation Profile: a spider-web diagram displays individual positioning across the five conservation dimensions, with a dotted line showing the average positioning of all respondents to date. This enables respondents to understand their personal nature conservation approach relative to collective responses and identify areas where their priorities align or differ from organisational peers.

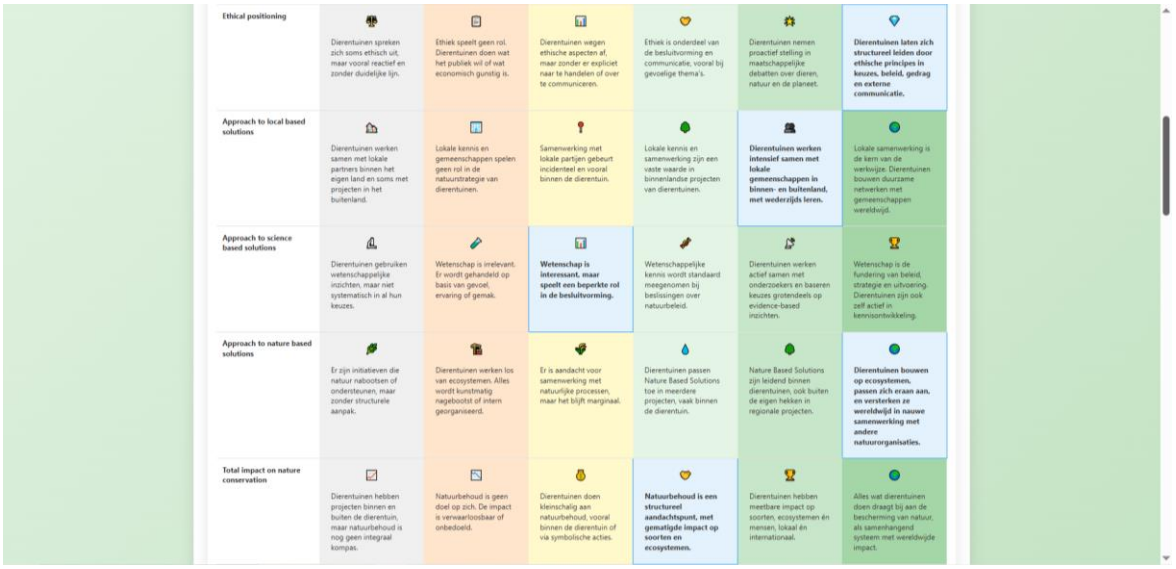


Screen 2 - Scenario Matching: an illustration, scenario title, and description present the organisational nature conservation scenario that best aligns with the respondents' answers. This screen includes existing organisational examples that resemble the chosen approach, potential partnership organisations with logo displays, and a comprehensive operational breakdown four key dimensions: organisational identity, internal operations, external relations, and viability factors across all institutional dimensions (see Appendix D). This breakdown distinguishes between factors directly influenced by organisational choice and consequential factors beyond immediate organisational control.

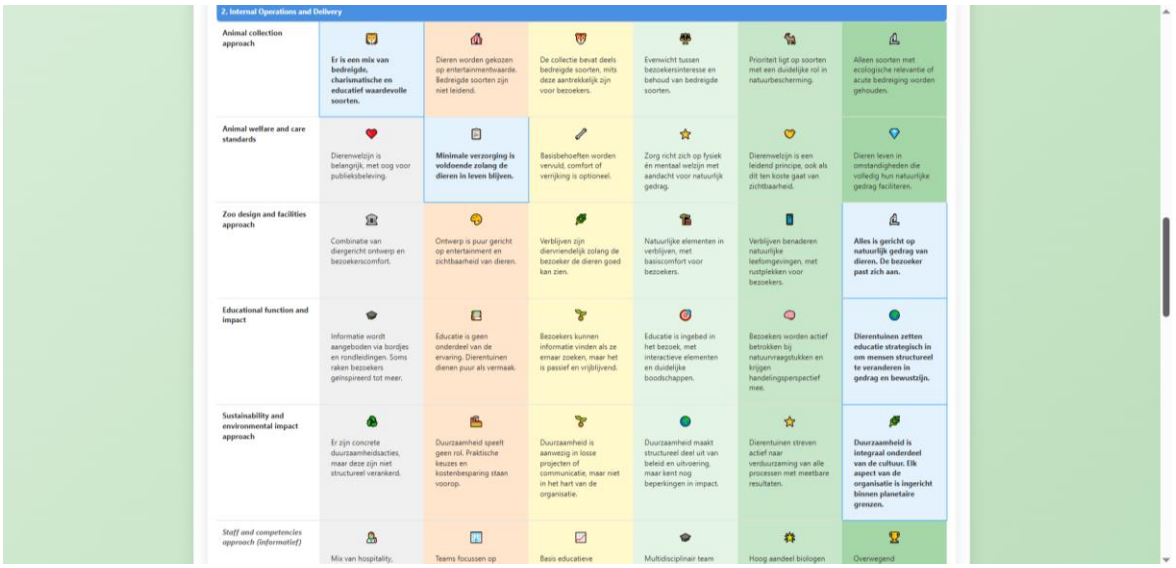


Screen 3 - Complete Scenario Comparison: percentage alignment bars show compatibility levels with all six organisational nature conservation scenarios, followed by a detailed comparison table. The table displays respondent answers (highlighted in blue) alongside each scenario's approach across the complete operational framework, revealing where individual perspectives align with or differ from each nature conservation strategy.



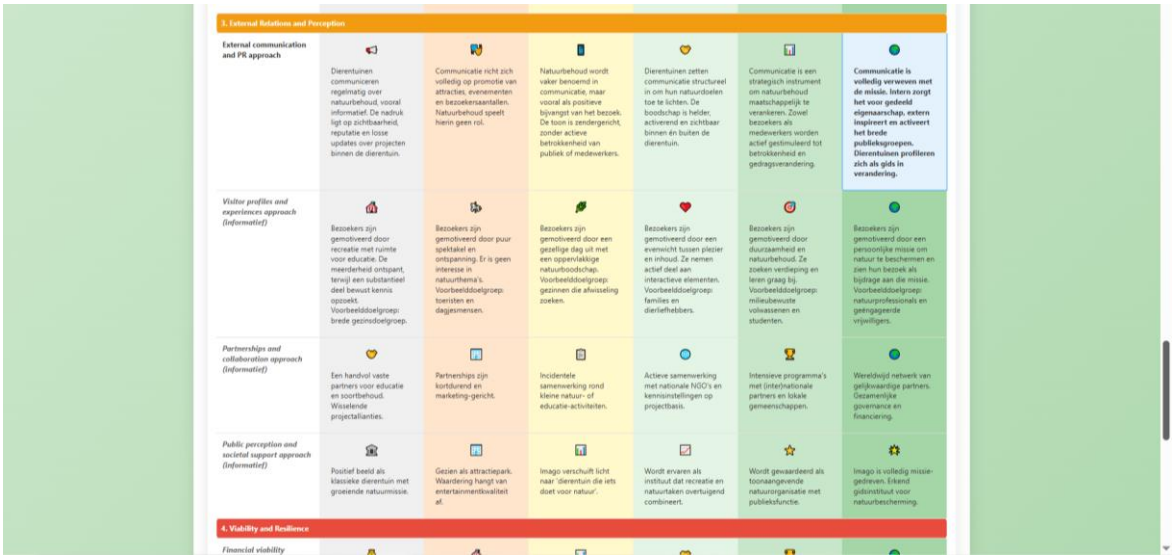


Ethical positioning	Dierentuinen spreken zich soms ethisch uit, maar vooral reactief en zonder duidelijke lijn.	Ethiek speelt geen rol. Dierentuinen doen wat het publiek wil of wat economisch gunstig is.	Dierentuinen wegen ethische aspecten af, maar zonder er expliciet naar te handelen of over te communiceren.	Ethiek is onderdeel van de besluitvorming en communicatie, vooral bij gevoelige thema's.	Dierentuinen nemen proactief stelling in maatschappelijke debatten over dieren, natuur en de planeet.	**Dierentuinen laten zich structureel leiden door ethische principes in keuzes, beleid, gedrag en externe communicatie.**
Approach to local based solutions	Dierentuinen werken samen met lokale partners binnen het eigen land en soms met projecten in het buitenland.	Lokale kennis en gemeenschappen spelen geen rol in de natuurstrategie van dierentuinen.	Samenwerking met lokale partijen gebeurt incidenteel en vooral binnen de dierentuin.	Lokale kennis en samenwerking zijn een vaste waarde in binnenlandse projecten van dierentuinen.	**Dierentuinen werken intensief samen met lokale gemeenschappen in binnen- en buitenland, met wederzijds leren.**	Lokale samenwerking is de kern van de werkwijze. Dierentuinen bouwen duurzame netwerken met gemeenschappen wereldwijd.
Approach to science based solutions	Dierentuinen gebruiken wetenschappelijke inzichten, maar niet systematisch in al hun keuzes.	Wetenschap is irrelevant. Er wordt gehandeld op basis van gevoel, ervaring of gemak.	**Wetenschap is interessant, maar speelt een beperkte rol in de besluitvorming.**	Wetenschappelijke kennis wordt standaard meegenomen bij beslissingen over natuurbeleid.	Dierentuinen werken actief samen met onderzoekers en baseren keuzes grotendeels op evidence-based inzichten.	Wetenschap is de fundering van beleid, strategie en uitvoering. Dierentuinen zijn ook zelf actief in kennisontwikkeling.
Approach to nature based solutions	Er zijn initiatieven die natuur nabootsen of ondersteunen, maar zonder structurele aanpak.	Dierentuinen werken los van ecosystemen. Alles wordt kunstmatig nagebootst of intern georganiseerd.	Er is aandacht voor samenwerking met natuurlijke processen, maar het blijft marginaal.	Dierentuinen passen Nature Based Solutions toe in meerdere projecten, vaak binnen de dierentuin.	Nature Based Solutions zijn leidend binnen dierentuinen, ook buiten de eigen hekken in regionale projecten.	**Dierentuinen bouwen op ecosystemen, passen zich eraan aan, en versterken ze wereldwijd in nauwe samenwerking met andere natuurorganisaties.**
Total impact on nature conservation	Dierentuinen hebben projecten binnen en buiten de dierentuin, maar natuurbehoud is nog geen integraal kompas.	Natuurbehoud is geen doel op zich. De impact is verwaarloosbaar of onbedoeld.	Dierentuinen doen kleinschalig aan natuurbehoud, vooral binnen de dierentuin of via symbolische acties.	**Natuurbehoud is een structureel aandachtspunt, met gematigde impact op soorten en ecosystemen.**	Dierentuinen hebben meetbare impact op soorten, ecosystemen én mensen, lokaal én internationaal.	Alles wat dierentuinen doen draagt bij aan de bescherming van natuur, als samenhangend systeem met wereldwijde impact.

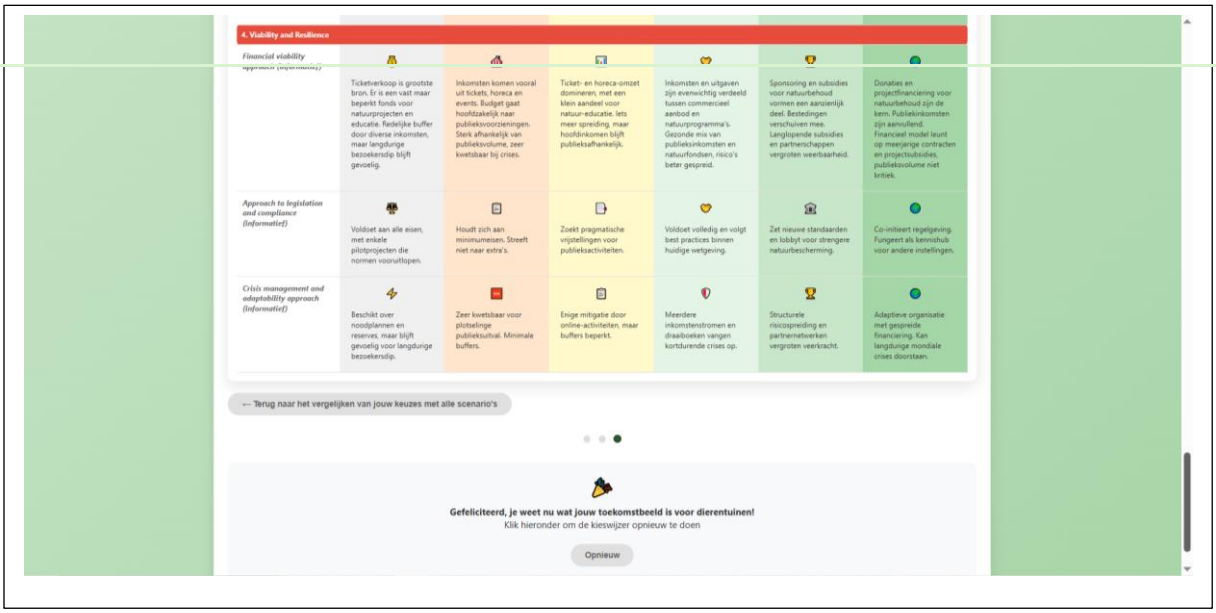


2. Internal Operations and Delivery						
Animal collection approach	**Er is een mix van bedreigde, charismatische en educatief waardevolle soorten.**	Dieren worden gekozen op entertainmentwaarde. Bedreigde soorten zijn niet leidend.	De collectie bevat deels bedreigde soorten, mits deze aantrekkelijk zijn voor bezoekers.	Evenwicht tussen bezoekersinteresse en behoud van bedreigde soorten.	Prioriteit ligt op soorten met een duidelijke rol in natuurbescherming.	Alleen soorten met ecologische relevantie of acute bedreiging worden gehouden.
Animal welfare and care standards	Dierenwelzijn is belangrijk, met oog voor publieksbeleving.	**Minimale verzorging is voldoende zolang de dieren in leven blijven.**	Basisbehoeften worden vervuld, comfort of verrijking is optioneel.	Zorg richt zich op fysiek én mentaal welzijn met aandacht voor natuurlijk gedrag.	Dierenwelzijn is een leidend principe, ook als dit ten koste gaat van zichtbaarheid.	Dieren leven in omstandigheden die volledig hun natuurlijke gedrag faciliteren.
Zoo design and facilities approach	Combinatie van diergericht ontwerp en bezoekerscomfort.	Ontwerp is puur gericht op entertainment en zichtbaarheid van dieren.	Verblijven zijn diervriendelijk zolang de bezoeker de dieren goed kan zien.	Natuurlijke elementen in verblijven, met basiscomfort voor bezoekers.	Verblijven benaderen natuurlijke leefomgevingen, met rustplekken voor bezoekers.	**Alles is gericht op natuurlijk gedrag van dieren. De bezoeker past zich aan.**
Educational function and impact	Informatie wordt aangeboden via bordjes en rondleidingen. Soms raken bezoekers geïnspireerd tot meer.	Educatie is geen onderdeel van de ervaring. Dierentuinen dienen puur als vermaak.	Bezoekers kunnen informatie vinden als ze ernaar zoeken, maar het is passief en vrijblijvend.	Educatie is ingebed in het bezoek, met interactieve elementen en duidelijke boodschappen.	Bezoekers worden actief betrokken bij natuurvraagstukken en krijgen handelingsperspectief mee.	**Dierentuinen zetten educatie strategisch in om mensen structureel te veranderen in gedrag en bewustzijn.**
Sustainability and environmental impact approach	Er zijn concrete duurzaamheidsacties, maar deze zijn niet structureel verankerd.	Duurzaamheid speelt geen rol. Praktische keuzes en kostenbesparing staan voorop.	Duurzaamheid is aanwezig in losse projecten of communicatie, maar niet in het hart van de organisatie.	Duurzaamheid maakt structureel deel uit van beleid en uitvoering, maar kent nog beperkingen in impact.	Dierentuinen streven actief naar verduurzaming van alle processen met meetbare resultaten.	**Duurzaamheid is integraal onderdeel van de cultuur. Elk aspect van de organisatie is ingericht binnen planetaire grenzen.**
Staff and competencies approach (informatief)	Mix van hospitality,	Teams focussen op	Basis educatieve	Multidisciplinair team	Hoog aandeel biologen	Overwegend

Staff and competencies approach (informatief)	Mix van hospitality, dierverzorgers en educatiespecialisten. Groeiende aandacht voor natuurexpertise.	Teams focussen op gastvrijheid en show. Beperkte natuurkennis vereist.	Basis educatieve vaardigheden. Natuurkennis sporadisch aanwezig.	Multidisciplinair team met combinatie van publieks- en natuurspecialisten.	Hoog aandeel biologen en duurzaamheidsexperts. Medewerkers krijgen natuurgerichte training.	Overwegend natuurspecialisten en community-managers. Publieksvaardigheden aanvullend.
Technology and innovation approach (informatief)	Technologie ondersteunt dagelijkse operatie en basisinformatie. Dierentuinen gebruiken digitale rondleiding-apps en eenvoudige sensoren voor monitoring.	Digitale middelen dienen vooral gemak en entertainment, zoals kassascans en grote videoschermen. Er is geen koppeling met natuurdoelen.	Interactieve infopunten en mobiele pagina's verrijken de bezoekerservaring, maar systemen staan los van dierenzorg en natuurmonitoring.	AR en VR-modules ondersteunen educatie, terwijl gestandaardiseerde sensoren automatisch welzijns- en leefomgevingsdata registreren voor intern gebruik.	Verbonden sensornetwerken, realtime dashboards en citizen-science-apps koppelen AR/VR-ervaringen aan data-inzameling voor ecosysteembeheer.	Een volledig geïntegreerd digitaal ecosysteem combineert AI-gestuurde habitatmodellen, open-data-platforms en immersieve XR-ervaringen die bezoekerseducatie, dierenzorg en wereldwijd onderzoek samenbrengen.

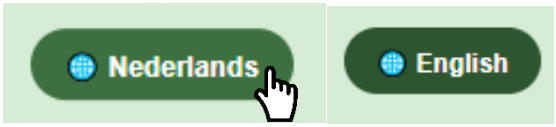


3. External Relations and Perception						
External communication and PR approach	Dierentuinen communiceren regelmatig over natuurbehoud, vooral informatief. De nadruk ligt op zichtbaarheid, reputatie en losse updates over projecten binnen de dierentuin.	Communicatie richt zich volledig op promotie van attracties, evenementen en bezoekersaantallen. Natuurbehoud speelt hierin geen rol.	Natuurbehoud wordt vaker benoemd in communicatie, maar vooral als positieve bijvangst van het bezoek. De toon is zendergericht, zonder actieve betrokkenheid van publiek of medewerkers.	Dierentuinen zetten communicatie structureel in om hun natuurdoelen toe te lichten. De boodschap is helder, activerend en zichtbaar binnen én buiten de dierentuin.	Communicatie is een strategisch instrument om natuurbehoud maatschappelijk te verankeren. Zowel bezoekers als medewerkers worden actief gestimuleerd tot betrokkenheid en gedragsverandering.	**Communicatie is volledig verweven met de missie. Intern zorgt het voor gedeeld eigenaarschap, extern inspireert en activeert het brede publieksgroepen. Dierentuinen profileren zich als gids in verandering.**
Visitor profiles and experiences approach (informatief)	Bezoekers zijn gemotiveerd door recreatie met ruimte voor educatie. De meerderheid ontspant, terwijl een substantieel deel bewust kennis opzoekt. Voorbeelddoelgroep: brede gezinsdoelgroep.	Bezoekers zijn gemotiveerd door puur spektakel en ontspanning. Er is geen interesse in natuurthema's. Voorbeelddoelgroep: toeristen en dagjesmensen.	Bezoekers zijn gemotiveerd door een gezellige dag uit met een oppervlakkige natuurboodschap. Voorbeelddoelgroep: gezinnen die afwisseling zoeken.	Bezoekers zijn gemotiveerd door een evenwicht tussen plezier en inhoud. Ze nemen actief deel aan interactieve elementen. Voorbeelddoelgroepi: families en dierliefhebbers.	Bezoekers zijn gemotiveerd door duurzaamheid en natuurbehoud. Ze zoeken verdieping en leren graag bij. Voorbeelddoelgroep: milieubewuste volwassenen en studenten.	Bezoekers zijn gemotiveerd door een persoonlijke missie om natuur te beschermen en zien hun bezoek als bijdrage aan die missie. Voorbeelddoelgroep: natuurprofessionals en geëngageerde vrijwilligers.
Partnerships and collaboration approach (informatief)	Een handvol vaste partners voor educatie en soortbehoud. Wisselende projectallianties.	Partnerships zijn kortdurend en marketing-gericht.	Incidentele samenwerking rond kleine natuur- of educatie-activiteiten.	Actieve samenwerking met nationale NGO's en kennisinstellingen op projectbasis.	Intensieve programma's met (inter)nationale partners en lokale gemeenschappen.	Wereldwijd netwerk van gelijkwaardige partners. Gezamenlijke governance en financiering.
Public perception and societal support approach (informatief)	Positief beeld als klassieke dierentuin met groeiende natuurmissie.	Gezien als attractiepark. Waardering hangt van entertainmentkwaliteit af.	Imago verschuift licht naar 'dierentuin die iets doet voor natuur'.	Wordt ervaren als instituut dat recreatie en natuurtaken overtuigend combineert.	Wordt gewaardeerd als toonaangevende natuurorganisatie met publieksfunctie.	Imago is volledig missie-gedreven. Erkend gidsinstituut voor natuurbescherming.
4. Viability and Resilience						
Financial viability						

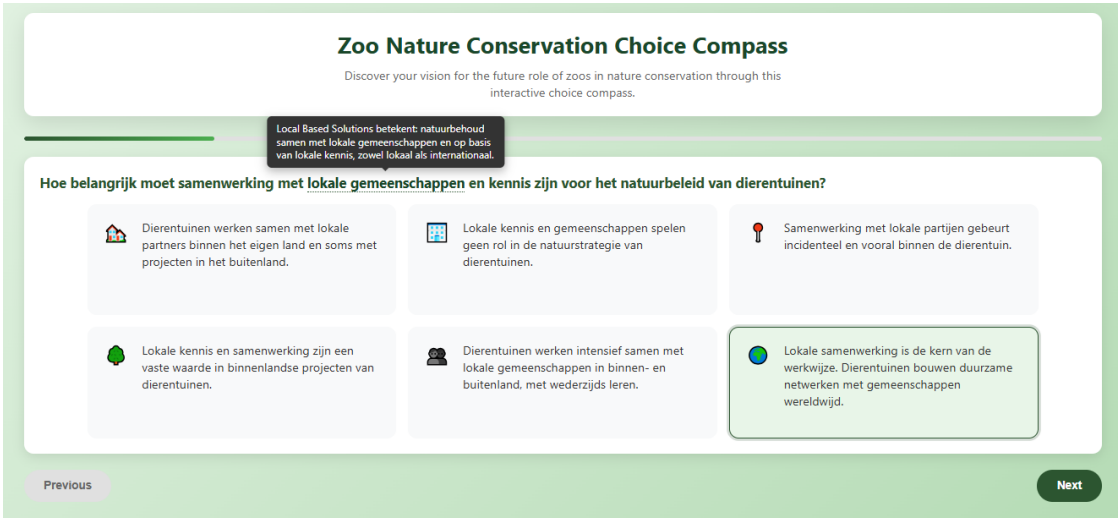


6.4.5 Key features of the choice compass

- **Bilingual functionality:** the choice compass operates in both English and Dutch through an integrated language switch, enabling use across international and domestic zoo networks.



- **Interactive definitions:** respondents can hover over key terms to access standardised definitions for concepts including nature-based approaches, science-based solutions, local-based engagement, and ethical positioning, ensuring consistent interpretation across all respondents.



- **Accessibility:** the choice compass provides a low-threshold and engaging introduction to organisational transformation and nature conservation complexities. Drawing from serious gaming research and game mechanics, it enables respondents to explore strategic positioning in an accessible manner, requiring minimal time investment while delivering comprehensive strategic insights.
- **Broad applicability:** while developed through research with Rotterdam Zoo, the choice compass applies to all zoological institutions addressing comparable strategic challenges. Furthermore, the systematic scenario framework extends beyond zoos to organisations in other contexts facing organisational transformation around any strategic topic, in particular sustainability or nature

conservation. The choice compass serves as an exploratory instrument and enables organisations to understand employee perspectives, identify current positioning, and evaluate alignment for strategic change across diverse transformation contexts.

- **Data collection and analysis:** the choice compass operates across all devices, enabling easy distribution and completion throughout organisations. All responses are automatically stored in a centralised system, providing real-time comparison with responses from other respondents and enabling comprehensive data analysis across employee groups. Specific questions are designed to facilitate pattern identification amongst different respondent groups, while the digital format ensures systematic data gathering for strategic insight generation. The tool can be easily updated and adapted when new insights emerge or organisational needs evolve.

6.5 Design process and choice compass rationale

6.5.1 Theoretical foundation in Design Wheel and Theory of Change

The Zoo Nature Conservation Choice Compass followed the Design Wheel methodology by Jan Buijs (2007), which structures innovation processes through systematic phases form opportunity identification through concept development to implementation. This iterative framework guided the entire design journey, from initial problem analysis through game development to final digital tool creation, ensuring comprehensive exploration of design alternatives while maintaining focus on evidence-based strategic outcomes. Additionally, the choice compass employs Theory of Change (ToC) methodology as its scientific foundation. Theory of Change, originally developed by Weiss (1995) as a "theory of how and why an initiative works", provides a systematic framework for mapping how interventions lead to desired change by identifying causal pathways from initial resources and inputs through activities and outputs to intermediate outcomes and ultimate impacts. The ToC framework proves particularly valuable for inter- and transdisciplinary sustainability research (Belcher *et al.*, 2020; Oberlack, *et al.*, 2019; Posner & Cvitanovic, 2018; Schneider *et al.*, 2019; Schneidewind & Rehm, 2019) where it maps out change processes in specific contexts and serves as a guiding framework for thinking, action, and sense-making when projects intervene in social change processes (Van Es *et al.*, 2015, as cited in Deutsch *et al.*, 2021). For zoo organisational transformation, ToC enables systematic analysis of how different resource allocations and activity combinations might contribute to dual objectives of organisational survival and meaningful conservation contribution. Each organisational nature conservation scenario within the choice compass represents a distinct Theory of Change for zoo-led nature conservation, systematically mapping how different nature conservation approaches can leverage organisational resources to achieve specific nature conservation impacts. This ToC-grounded approach transforms abstract nature conservation aspirations into the concrete, analysable strategic pathways that comprise the choice compass' six scenarios (see Appendix E for detailed ToC framework explanation).

6.5.2 Literature review and zoo trends as design foundation

Extensive zoo trends research and literature analysis provided the foundation for developing the six organisational nature conservation scenarios and their operational specifications. This research identified transformation patterns across the global zoo sector, nature conservation effectiveness research, and emerging approaches to zoo-based nature conservation. A secondary literature review systematically examined scientific evidence for every topic addressed within the choice compass, from animal welfare standards and visitor engagement strategies to partnership strategies and funding models. This academic foundation ensures that each scenario, question, and response option within the choice compass represents scientifically validated rather than speculative approaches, enabling evidence-based strategic guidance that maintains credibility with both internal stakeholders and external nature conservation partners. This literature review drew upon: (Allen, 2018, 2025; Barongi *et al.*, 2015; Beck, 1995; Diergaarde Blijdorp, n.d.d, 2025; EAZA, 2024; Fraser & Wharton, 2007; Gusset & Dick, 2010; Hoogen Stoevenbeld, 2019; Hutchins, 2003; Hutchins *et al.*, 2003; Jamieson, 2020; Kagan *et al.*, 2018; Keulartz, 2023; Kraak, 2008; Landman & Visscher, 2008; Mellish *et al.*, 2018; Mellish *et al.*, 2019; Mellish *et al.*, 2021; Mellor *et al.*, 2015; Mooney *et al.*, 2020; Moss & Esson, 2013; Pagel, 2020; Patrick *et al.*, 2007; Rabb & Saunders, 2005;

RDA, 2025; Rees, 2023; Rose & Riley, 2022; Spooner *et al.*, 2023; Stefanov, 2020; Stichting Koninklijke Rotterdamse Diergaarde, 2021, 2022, 2023; Thomas, 2020; Tribe & Booth, 2003).

6.5.3 Bonaire insights on physical interaction and decision-making

Interview research conducted on Bonaire using Q-sort methodology revealed the fundamental value of tangible for complex decision-making processes. Participants consistently expressed appreciation for having physical elements they could manipulate and observe from different perspectives, enabling them to externalise abstract concepts and visualise complex relationships in ways that traditional verbal discussions could not achieve. These insights directly informed the choice compass design through its emphasis on visual representation of trade-offs via the spider-web diagram and concrete scenario breakdowns that make abstract nature conservation concepts tangible. The research on Bonaire also demonstrated that meaningful strategic positioning requires accepting constraints and making difficult choices, leading to the choice compass's deliberate employment of choice-forcing design principles rather than conventional agreement scales. Respondents must make explicit choices between competing alternatives because zoo transformation fundamentally requires decisive trade-offs rather than neutral positioning.

6.5.4 Game development through board game analysis and co-creation

The zoo nature conservation transformation can be metaphorically understood as a complex control panel with interconnected elements, where adjusting one component inevitably affects others throughout the system. This analogy led to exploring serious gaming that excels at representing such dynamic systems and cause-and-effect relationships.

The design incorporates serious gaming mechanics informed by extensive analysis of over 50 board games and expert interviews with a professional board game developer from Identity Games and a board game specialist. This analysis focused on mechanisms that could effectively represent zoo nature conservation dynamics, examining games featuring collaboration and partnership systems, resource management mechanics, long-term strategic planning elements, and external event integration. These components were identified as essential for simulating key aspects of zoo operations and nature conservation work. Furthermore, the design process involved intensive co-creation and iterative testing sessions with peers and employees from Rotterdam Zoo and RoffaReefs to validate and refine design concepts. The research first culminated in developing a fully functional board game prototype that simulated zoo operations from 2025 to 2050, aligning with Rotterdam Zoo's Masterplan 2050 timeline. The game required players to balance financial sustainability with nature conservation goal achievement, revealing crucial insights that directly translate into choice compass features.

Drawing from RoffaReefs' nature-based, science-based, and local-based nature conservation approach, the game required balanced investment across all three pillars to achieve nature conservation progress. Players could not reach higher nature conservation scenario targets by concentrating exclusively on one pillar, demonstrating the interconnectedness and necessity of integrating all three approaches for effective nature conservation outcomes. This insight translates into the choice compass through the spider-web diagram that visualises the interdependencies between all five nature conservation dimensions, and ranking questions that reveal how users prioritise across the three pillars, making explicit the trade-offs inherent in nature conservation strategy development.

The game incorporated external event cards simulating unpredictable challenges drawn from actual Rotterdam Zoo specific and sector-wide zoo experiences including regulatory changes, public opinion shifts, partnership opportunities, and crises such as pandemics. These events affected players differently based on their strategic choices, demonstrating how organisational positioning creates resilience or vulnerability to future challenges. This gaming insight translates into the choice compass through the informational columns in both the scenario breakdown overview and scenario comparison table, which show consequence factors beyond direct organisational control such as legislative compliance requirements and crisis management approaches.

Financial dynamics research revealed fundamental differences between animal and non-animal attraction performance profiles. Animal exhibits generated substantial visitor income but demonstrated heightened vulnerability to external disruptions, while non-animal attractions provided consistent income streams with reduces susceptibility to external events. Players discovered that sustainable transformation required income diversification strategies and gradual shifts from visitor-dependent revenue towards varied funding sources. These insights translate into the choice compass through progressive income diversification patterns, where the higher nature conservation scenarios incorporate funding from grants, partnerships, and research subsidies rather than relying exclusively on visitor revenue.

Furthermore, the game's S-curve progression model for animal attractions, where initial additions provided significant visitor appeal but returns diminished substantially as collections expanded, revealed saturation effects in traditional zoo models (since the difference between 0 and 1 animals proves more extensive than between 50 and 51 animals). Non-animal attractions followed linear progression patterns with consistent returns and reduced vulnerability to external disruptions such as disease outbreaks, welfare regulations requiring facility modifications, or policy changes affecting animal housing standards. This insight translates into the choice compass through the technology integration patterns in higher nature conservation scenarios, where advanced immersive technological solutions increasingly supplement or replace animal attractions for visitor engagement while supporting nature conservation and education objectives. Furthermore, game testing revealed that players initially focused on revenue generation rather than nature conservation investment, only realizing late in gameplay that conservation required long-term commitment to achieve their goals. This demonstrated that nature conservation must be integrated from the beginning of institutional transformation rather than treated as a later addition.

6.5.5 Strategic pivot from board game to digital decision-support tool

Co-creation sessions with Rotterdam Zoo employees and RoffaReefs team members revealed that while players valued the strategic insights generated through gameplay, they consistently identified the scenario selection reference table used at the game's beginning as containing the essential strategic clarity needed for organisational decision-making. This table presented different nature conservation commitment levels with their practical operational implications across animal collection, partnerships, funding, and organisational structure. Players used this table to establish their nature conservation goals before engaging in detailed operational planning in the game, but feedback indicated that understanding these strategic positioning options constituted the primary value rather than the gameplay mechanics themselves. This realisation prompted a strategic pivot towards extracting and refining this core element into the current Zoo Nature Conservation Choice Compass, focusing on strategic positioning clarity rather than implementation simulation.

6.5.6 Implementation approach combining digital distribution and physical workshops

The choice compass employs a hybrid digital-physical approach informed by implementation requirements and stakeholder feedback. The digital format enables rapid and easy distribution throughout institutions while centralising data collection for analysis. This approach facilitates easy tool dissemination while enabling systematic examination of response patterns and allows for updates and modifications based on testing insights. However, research insights from Bonaire emphasises the continued value of physical interaction for deeper strategic discussions. Therefore, the design incorporates follow-up physical workshop sessions where teams collectively discuss the results from the digital choice compass, examine underlying perspectives behind responses, and identify areas where consensus and dissensus exist among employees. These sessions enable translation of individual insights into collaborative strategic planning for organisational transformation.

6.6 Implementation strategy

The Zoo Nature Conservation Choice Compass employs a hybrid digital-physical implementation approach informed by stakeholder feedback from Rotterdam Zoo and RoffaReefs employees. This hybrid approach recognises that while digital tools excel at broad organisational reach and individual reflection, physical gatherings remain essential for building shared understanding and discussing organisational direction among employees.

Distribution of the choice compass occurs through multiple channels identified during testing as most effective for organisational adoption. Initial testing with the BCSC department provides validation before broader implementation through the organisation's intranet system. Direct personal outreach will likely generate highest completion rates by approaching employees individually, for example during lunch breaks, complemented by email distribution and strategic placement of QR codes linking to the choice compass in common employee areas throughout the zoo. The digital format provides advantages for organisational implementation as the tool can spread organically through the organisation when employees share experiences and insights with colleagues. Employee feedback indicated genuine enthusiasm for completing the choice compass and discovering results, supporting organic adoption throughout the organisation. Its self-contained and simple design means users can engage independently, without requiring facilitated sessions or extensive training before completing the choice compass.

Furthermore, implementation leverages Rotterdam Zoo's quarterly soapbox (*'zeepkist'*) sessions, established organisational gatherings where employees from various departments evaluate and discuss workplace experiences. Multiple employees identified these sessions as ideal opportunities for collective tool use and strategic discussion, though departmental sessions can be organised without waiting for quarterly meetings.

Following individual completion of the choice compass, workshop sessions provide opportunities for collective discussion about institutional direction. These sessions focus on translating insights into organisational implications and determining next steps for institutional development. The workshop framework involves three phases:

- **Pre-workshop digital engagement** requires employees to individually complete the choice navigator, generating personal insights about nature conservation positioning and understanding the implications of different strategic organisational directions
- **Collective sense-making during physical workshops** where participants share and compare individual results, identifying patterns, conflicts, and convergences in organisational perspectives and nature conservation positioning
- **Strategic synthesis through facilitated discussions** that help groups move from individual insights to collective understanding while developing approaches for addressing divergent viewpoints.

These workshop sessions will employ probing and latent knowledge techniques developed during the research on Bonaire (see Appendix FIMXME) to uncover underlying employee perspectives and motivations behind response patterns. Furthermore, these sessions incorporate the Q-sort exercises on nature conservation positioning designed specifically for both Bonaire and Rotterdam Zoo contexts, providing ready-to-use methodologies. Additionally, physical visualisation of the scenario comparison table enables participants to place markers indicating their personal responses, creating visible consensus and dissensus clusters. Discussions will focus on examining the reasoning behind different perspectives, and exploring how diverse viewpoints can inform organisational strategic development.

The digital format enables systematic data collection, allowing organisational leaders to understand patterns in employee perspectives and identify areas where additional communication or alignment efforts might be beneficial. This data-driven approach supports evidence-based strategic decision-making while respecting individual perspectives and departmental differences. Employee feedback emphasised the value of mapping all employee perspectives and creating bridges between management and staff for more integrated rather than top-down institutional direction development. Everyone interviewed expressed positivity about the choice compass' potential contribution to generating insights for strategic direction and understanding perspectives across the organisation. Understanding these diverse employee perspectives enables more effective communication during organisational transformation, as the research on Bonaire demonstrated that successful change requires speaking the same language as stakeholders across all organisational levels (see Chapter 4).

The choice compass serves multiple strategic applications beyond initial strategic positioning assessment. Management identified valuable applications for volunteer and employee selection processes, enabling assessment of individual alignment with organisational nature conservation positioning to ensure good cultural fit during recruitment. Additionally, the choice compass proves valuable for employee satisfaction research regarding organisational vision. Rather than requiring consensus, diverse perspectives can initiate constructive conversations about organisational alignment and strategic direction.

While based on research with Rotterdam Zoo, the choice compass is developed as a broadly applicable tool for all zoological institutions facing comparable strategic challenges. The modular structure allows customisation of scenarios, questions, and organisational examples while maintaining core choice-forcing principles. Beyond zoo contexts, the systematic framework can be adapted for other organisational transformation challenges, including employee satisfaction research and strategic positioning assessment across diverse sectors and topics.

6.7 Conclusion

The Zoo Nature Conservation Choice Compass successfully achieves the design goal by enabling zoo employees to explore their personal conservation perspectives and understand the operational implications of different strategic scenarios, thereby supporting informed decision-making about institutional conservation positioning. Through six concrete operational scenarios and choice-forcing design principles, the tool translates abstract nature conservation ambitions into actionable strategic insights. The hybrid digital-physical implementation approach further enhances this by combining individual reflection with collective discussion, supporting both personal understanding and organisational transformation. Most importantly, the Choice Compass addresses the critical implementation gap identified in Chapters 3 and 5 between nature conservation intentions and operational reality by demanding concrete choices about what the organisation will and will not do.

7

The research identified several areas for enhancement across three main components: zoo sector research and trend analysis, Bonaire stakeholder research, and development of the Zoo Nature Conservation Choice Compass (a digital decision-support tool for exploring strategic positioning in nature conservation and gaining insights into operational consequences).

Zoo sector research would benefit from continuous trend monitoring given the rapidly evolving conservation landscape, while broader geographic and cultural contexts could strengthen applicability. The Bonaire stakeholder research revealed opportunities to refine Q-sort methodology (where participants rank statements in pyramid distributions) through expanded participant freedom and complementary research approaches. The grid exercise (mapping organisations by conservation impact and local engagement) highlighted potential improvements in standardised assessment criteria and addressing temporal bias in organisational evaluations. The Zoo Nature Conservation Choice Compass showed promise for enhanced scoring algorithms and question design refinement.

H7. Discussion and limitations

This chapter examines the limitations encountered across the three main research components: zoo sector research and trend analysis, Bonaire stakeholder research, and choice compass development. Understanding these constraints provides context for interpreting findings and identifying areas for future development.

7.1 Zoo research

While extensive literature analysis and trend research provided foundational understanding of zoo sector transformation patterns, several limitations emerged from the research approach and scope. The rapidly evolving nature of conservation approaches means that static analysis may quickly become outdated, requiring continuous monitoring of sector developments. Moreover, the research scope was primarily focused on Western zoological institutions, potentially limiting applicability to zoos operating in different cultural, economic, or regulatory contexts.

The reliance on published literature introduced potential publication bias, where successful transformation cases receive more academic attention than failed attempts or struggling institutions. Additionally, while Rotterdam Zoo provided internal information through conducted interviews with relevant departments, access to internal operational data from other zoological institutions remained limited. This constrained analysis to publicly available information that may not reflect complete operational realities across diverse institutional contexts.

7.2 Bonaire Research

7.2.1 Limitations of Q-sort methodology

Methodological constraints

While the use of Q-sort methodology has revealed 11 areas of consensus among a wide range of stakeholders, each with different perspectives and objectives, the method itself presents inherent constraints. The fixed pyramidical distribution required for statement sorting represents a fundamental limitation (Brown, 1996; Zabala, 2014; Zabala *et al.*, 2018). Had stakeholders been afforded greater freedom to rank statements outside this prescribed distribution, the results would likely have differed considerably. Furthermore, the statistical interpretation of findings remains constrained to the Q-sorts themselves, rather than providing scope to interpret or critique the underlying issues, such as the added value of pursuing concurrent economic and environmental objectives. These critical perspectives were only partially incorporated through post-sorting stakeholder interviews and factor interpretation, potentially omitting significant aspects of the broader discussion. Therefore, further research is recommended to build upon this study.

Participant-related limitations

The Q-methodology's reliance on personal interviews and participants' subjective views on potentially sensitive issues introduces several disadvantages (Brown, 1996; Zabala, 2014; Zabala *et al.*, 2018). Firstly, Q-methodology represents an intellectually challenging and lengthy process that demands participants possess substantial topic knowledge while requiring considerable patience and time investment from both participants and interviewers (Kampen & Tamás, 2013; Zabala, 2014; Zabala *et al.*, 2018). Secondly, multiple potential sources of bias emerge throughout the process (Broussard *et al.*, 2023). Participant willingness to engage in the study may be influenced by their knowledge that results will support particular positions they favour (Webler *et al.*, 2009), while individual interpretation of statements varies according to differences in backgrounds, political ideology, and education levels – all factors that influence how Q-set statements are sorted and ranked (Broussard *et al.*, 2023). Additionally, the interview process itself may be subject to bias arising from differences between participants and interviewers in terms of age, gender, culture, and language, all of which affect how interview questions are answered and subsequently interpret (Webler *et al.*, 2009).

Furthermore, participants themselves acknowledged during the study that their responses might have varied had the interviews been conducted on different days, at alternative times, or following significant events such as important board meetings, political developments, economic shifts, regulatory changes, or ecological events.

Generalisability limitations

As a consequence of sampling perspectives rather than populations, Q-sort methodology does not provide the possibility to generalise the results to the entire population, though it does permit the description of social perspectives that also exist beyond the specific group of people surveyed (Zawilińska *et al.*, 2023). However, it must be emphasised that the perspectives emerging as a result from the analysis may not cover all possible perspectives in the entire population (Sneegas *et al.*, 2021). This limitation necessitates careful consideration when drawing broader conclusions from Q-methodology findings and suggests the value of complementary research approaches to provide a more comprehensive understanding of stakeholder perspectives.

7.2.2 Limitations of the grid exercise

Methodological limitations

The grid exercise methodology, while providing a visual representation of perceived relationships between positive nature conservation impact and local engagement amongst Bonaire-based organisations, presents several inherent limitations that must be acknowledged. The placement of organisational logos on the grid represents a fundamentally relative and imprecise measurement system. Participants were required to make subjective assessments without standardised criteria or quantitative metrics, resulting in positioning decisions that reflect rather personal perceptions rather than objective measurements of nature conservation impact or local engagement levels.

Participant knowledge and bias

A significant limitation emerged from the varying levels of participant familiarity with different organisations. Participants naturally demonstrated bias towards organisations with which they were personally affiliated or had collaborative relationships, as their intimate knowledge of these entities' goals and activities enabled more detailed assessments of both nature conservation impact and local engagement efforts. This insider knowledge created an uneven playing field, where familiar organisations received more nuanced positioning based on comprehensive understanding of their operations.

Conversely, when participants possessed limited knowledge about particular organisations, the positioning process became increasingly speculative. Two distinct scenarios emerged: participants who acknowledged complete unfamiliarity with certain organisations typically positioned these entities in the centre of the grid as 'neutral', while those with partial knowledge (for example recognising organisational names but not having substantive understanding of their activities) engaged in more uncertain positioning decisions. For organisations falling in the latter category of partial familiarity, participants exhibited a tendency to make uncertain assessments about the positioning of these entities. This may have resulted in underestimation or overestimation of actual organisational performance on nature conservation impact and local community engagement. This uncertainty in positioning meant that organisations may not have been accurately represented, though the direction and extent of any misinterpretation remains unclear.

Notably, organisations that maintained close collaborative relationships with other entities tended to receive higher conservation impact scores, as participants possessed greater insight into their activities through these partnerships. Similarly, organisations that actively communicated their nature conservation and local community work to external audiences generally achieved higher positioning on both axes, suggesting that visibility and outreach influenced perceptions of effectiveness. On the contrary, organisations not directly related to nature conservation consistently scored lower on positive nature conservation impact, regardless of any indirect contributions they might have made to environmental outcomes.

Interpretive ambiguities

The exercise revealed considerable interpretive challenges in defining and assessing both nature conservation impact and local engagement. Some organisations demonstrated substantial positive nature conservation impact but engaged in limited communication or outreach regarding their efforts, creating ambiguity about how such cases should be positioned on the grid. This highlighted the subjective nature of determining what constitutes meaningful local engagement and whether it necessarily correlates with nature conservation effectiveness.

Resource-related disparities

Organisational positioning may have been influenced by resource availability, with better-funded entities potentially appearing to achieve greater impact due to enhanced operational capacity rather than superior strategy or efficiency. This potential conflation between resource access and conservation effectiveness could obscure whether observed differences reflect genuine performance variations or merely resource-driven operational scales. However, this remains a theoretical consideration, as the grid exercise did not systematically assess resource levels or establish direct correlations between funding and positioning outcomes.

Temporal bias

Participants' assessments were significantly influenced by historical rather than current organisational performance. Several organisations that had previously demonstrated substantial positive nature conservation impact but had since reduced their activities continued to receive favourable grid positioning based on past achievements rather than contemporary performance. This temporal bias suggests that the exercise captured organisational reputation and historical memory as much as current nature conservation effectiveness and local engagement levels.

Subjective nature and validity concerns

The fundamentally subjective nature of the grid exercise raises serious questions about the validity of drawing definitive conclusions from the results. The combination of varying participant knowledge, interpretive ambiguities, resource disparities, and temporal biases creates a complex web of potential confounding factors that compromise the exercise's ability to provide subjective insights into the relationship between positive nature conservation impact and local engagement. The lack of standardised assessment criteria further compounds these limitations, suggesting that the exercise functions better as an exploratory tool for understanding stakeholder perceptions rather than as means of establishing empirical relationships between organisational characteristics.

7.2.3 Zoo Nature Conservation Choice Compass

Development and testing of the choice compass revealed several areas for potential enhancement. For instance, code optimisation could improve precision of the current scoring algorithm and enable more sophisticated data analysis capabilities. The scoring system provides reliable scenario matching, though refinement could enhance comparative analysis across user responses.

User feedback highlighted opportunities for question design improvement. Some six-option questions could benefit from clearer distinction between alternatives to strengthen choice-forcing effectiveness. Rotterdam Zoo employees suggested that three response options might create more decisive and distinct choices while maintaining comprehensibility. Finding the optimal balance between forcing difficult decisions and ensuring comprehensibility requires further refinement.

Furthermore, current accessibility features accommodate standard users, though expansion to include visual impairment support would broaden participation. Additionally, language options currently cover English and Dutch markets, with potential for international expansion. Project timeframe constraints focused validation primarily on Rotterdam Zoo contexts, providing opportunities for broader institutional testing. Scenario development and question formulation followed systematic literature review methodology, though inherent subjectivity in framing conservation approaches represents a consideration for future iterations.

8

Strategic recommendations focus on three areas: Bonaire research applications, zoo sector development, and Zoo Nature Conservation Choice Compass enhancement. For Bonaire applications, systematic partnership evaluation and regular stakeholder monitoring would strengthen nature conservation outcomes for the RoffaReefs' coral reef restoration programme under Rotterdam Zoo. Zoo sector development could benefit from expanding the Choice Compass to other institutions and incorporating visitor engagement research. Technical improvements include algorithm refinement, enhanced accessibility features, and broader language options. Further validation through focused testing would strengthen reliability before wider implementation.

H8. Recommendations and next steps

Based on the research findings and tool development insights, this chapter presents strategic recommendations across three key areas: Bonaire research applications, zoo research expansion, and Zoo Nature Conservation Choice Compass enhancement.

8.1 Bonaire research applications

The conducted research on Bonaire revealed significant insights about stakeholder perspectives on nature conservation partnerships and local engagement. Building upon these findings, Rotterdam Zoo would benefit from systematically evaluating all current partnerships to identify organisations that genuinely align with the zoo's nature conservation objectives rather than serving promotional purposes. This evaluation process should incorporate regular stakeholder interviews to monitor evolving perceptions of Rotterdam Zoo among different community groups. Such longitudinal tracking would provide evidence for whether increased engagement efforts effectively strengthen relationships and improve nature conservation outcomes across diverse partnership contexts.

Effective partnership development requires context-sensitive approaches that acknowledge the distinct characteristics of Dutch urban communities and Caribbean island populations. In the Netherlands, this involves strengthening connections with Rotterdam communities, regional nature conservation groups, and Dutch environmental organisations. For international partnerships such as those on Bonaire, success depends on understanding how the zoo can provide meaningful value to local communities while learning from local expertise. Despite geographical and cultural differences, all effective nature conservation partnerships share common requirements for genuine community integration and reciprocal knowledge exchange.

8.2 Zoo sector development

The Zoo Nature Conservation Choice Compass demonstrates potential for broader application beyond Rotterdam Zoo, requiring systematic adaptation of scenarios, questions, and organisational examples for different institutional contexts. Such expansion would enable comparative analysis of nature conservation positioning across multiple zoological institutions and strengthen understanding of sector-wide transformation patterns.

Beyond institutional application, the tool concept could be adapted for visitor engagement research. Conducting visitor surveys using modified versions of the positioning framework would reveal public expectations regarding zoo transformation and enable institutions to involve visitors strategically in decision-making processes. This approach could challenge assumptions about public preferences and provide evidence for potential shifts from entertainment-focused approaches toward conservation-oriented positioning.

Continued trend research remains essential given the rapidly evolving conservation landscape. While extensive literature analysis provided foundational understanding, ongoing monitoring of sector developments, regulatory changes, and emerging conservation approaches would continuously enhance scenario specifications and improve operational detail accuracy. Additionally, future research should investigate available funding sources, grants, and subsidies that support nature conservation initiatives within zoological institutions, providing concrete guidance for institutions pursuing higher conservation scenarios and enabling more realistic financial planning for transformation initiatives.

8.3 Choice Compass enhancement and future development

Technical improvements

The Zoo Nature Conservation Choice Compass requires several technical improvements to enhance effectiveness. The scoring algorithm would benefit from refinement to ensure more consistent result generation across different user sessions. Additionally, experimenting with different question formats, specifically comparing three versus six answer options, would help determine which approach creates more effective decision-making for users. User feedback also indicated that sharper question wording would eliminate occasional ambiguity and improve clarity. Finally, expanding the data analysis functions would better process and visualise collected responses for deeper organisational insights.

Development and testing strategy

Further validation would strengthen the choice compass' reliability and broaden its applicability. Testing improvements with a single Rotterdam Zoo department, for example BCSC, would provide focused feedback while allowing refinement without organisational disruption. Once validated internally, the tool could be adapted for other zoos by modifying scenarios and examples to fit different institutional contexts. Expanded testing with varied user groups, such as different management levels, zoo types, and international institutions, would reveal additional enhancement opportunities. Each testing cycle should inform subsequent development iterations to strengthen tool effectiveness and user experience.

Accessibility and inclusion

Enhancing accessibility would significantly expand the choice compass' reach and impact. Adding screen reader compatibility would include visually impaired users, while additional language options, particularly Papiamentu for Bonaire applications, would enable broader stakeholder participation and geographic applicability.

Alternative applications

The choice compass framework offers potential for addressing other organisational challenges beyond strategic positioning. Applications for recruitment decisions, volunteer selection, and strategic planning would maximise value within zoological contexts before expanding to other sectors. Incorporating diverse perspectives from zoo staff, nature conservation experts, and community representatives throughout the development process would improve both relevance and adoption rates.

Optional extensions

The board game prototype, originally developed as part of this research, could enhance workshop evaluation sessions by helping employees explore operational implications of strategic choices through hands-on gameplay. Whether used for substantive exploration of transformation trade-offs or as a conversation starter, this physical tool would complement the digital choice compass during collective discussions about organisational direction. While the digital choice compass represents the primary implementation pathway, integrating the board game into workshop sessions would provide experiential learning opportunities that enhance collective strategic reflection.

9

The research demonstrates that successful zoo transformation requires integrating human ecosystems alongside technical and scientific nature conservation approaches. To address inevitable transformation pressures, zoos can maximise their nature conservation impact by connecting the public with conservation work through engaging visitors, involving diverse organisations in conservation initiatives, actively contributing to policy making, and participating in broader nature conservation networks. The Zoo Nature Conservation Choice Compass addresses implementation challenges by translating strategic scenarios into operational implications. Success depends on genuine organisational transformation across all dimensions rather than superficial additions to existing structures, with broader implications for sustainability sector organisations pursuing authentic change.

H9. Conclusion

This research addressed the question *"How can zoos be enabled to define and position their role in nature conservation and explore different strategic scenarios while gaining insight into their operational and stakeholder implications?"*. The study revealed that successful zoo transformation depends fundamentally on integrating the human ecosystem alongside technical nature conservation approaches, a critical insight that transforms how zoos can contribute to global nature conservation efforts.

9.1 Key research findings

Zoo transformation is inevitable rather than optional, with institutions facing a choice between nature conservation leadership or declining relevance due to converging ethical, financial, and effectiveness pressures (Sub-question 1). Rotterdam Zoo exemplifies these sector-wide transformation challenges through its commitment to becoming a nature restoration organisation, as outlined in Masterplan 2050. This strategic ambition highlights the broader implementation challenge facing zoos: translating visionary goals into concrete operational choices across all organisational dimensions (Sub-question 2). To understand how zoos can successfully bridge this gap, the RoffaReefs case study and stakeholder interviews on Bonaire were analysed as an example of zoo-led in situ nature conservation, revealing that success requires integrating three foundational pillars: nature-based practices, science-based approaches, and local-based partnerships within socio-ecological ecosystems (Sub-question 3). These findings revealed a critical gap between nature conservation ambitions and practical implementation across the zoo sector. Building on these insights, the Zoo Nature Conservation Choice Compass was developed to address this implementation challenge. The tool translates abstract nature conservation scenarios into tangible operational implications, enabling zoos to make informed decisions about their institutional positioning and understand the practical consequences of different transformation pathways (Sub-question 4).

9.2 The transformative potential of the local pillar

This research reveals that successful nature conservation depends on integrating local stakeholders as genuine partners rather than relying solely on technical expertise or financial resources. People determine whether nature conservation succeeds because they execute the work, provide funding, and ultimately decide to value and support nature protection.

For zoos facing inevitable transformation pressure, this finding is crucial: their survival and relevance depend on demonstrating genuine nature conservation impact, which requires effective stakeholder engagement. Therefore, zoos must clearly define and position their role in nature conservation and translate that mission into concrete operational practice. The Zoo Nature Conservation Choice Compass directly addresses the research question by enabling zoos to explore six strategic scenarios and gain insights into what each positioning requires operationally. This way, the choice compass bridges the gap between nature conservation aspirations and practical implementation by showing zoos what their strategic positioning means for daily operations, partnerships, staffing, and stakeholder relationships.

The research reveals that zoos can maximise their nature conservation impact by serving as bridges between their facilities and *in situ* nature conservation through engaging stakeholders in both contexts: local communities in conservation regions and visitors at zoo facilities. However, this bridging function requires zoos to clearly define and position their role in nature conservation while communicating transparently about their capabilities and limitations.

Furthermore, the research demonstrates that zoos face inherent resource constraints requiring strategic trade-offs in operational decisions, as financial resources can only be allocated once among competing organisational priorities. This limitation means no single organisation can address all nature conservation requirements independently. Therefore, clear role definition also becomes essential for maximising nature conservation impact. Internally, this prevents competing organisational priorities from fragmenting limited resources, while externally it enables strategic partnerships where organisations contribute

complementary expertise rather than duplicating nature conservation efforts. The research on Bonaire revealed how programmes such as RoffaReefs establish effective collaborative relationships through explicit and role agreements with partners such as Piskabon, ensuring mutual benefit rather than one-way extraction.

However, realising this potential requires authentic organisational transformation that extends beyond strategic positioning to operational implementation. The research demonstrates that zoos must involve employees as active participants in defining the institutional nature conservation mission while simultaneously transforming visitors from entertainment consumers into active conservation partners. More critically, this transformation must encompass all organisational dimensions including resource allocation, partnership strategies, species collection decisions, and revenue diversification away from visitor-dependent income streams. Without such operational alignment, nature conservation initiatives risk remaining superficial additions to traditional entertainment structures rather than achieving the fundamental institutional transformation necessary for genuine nature conservation impact.

9.3 Broader implications

This research contributes to understanding organisational transformation in the sustainability sector, demonstrating that authentic change requires systematic integration of social and technical dimensions rather than layering new missions onto existing structures. For the zoo sector specifically, this study provides a framework for navigating the inevitable transformation from entertainment venues to nature conservation organisations while maintaining institutional viability.

The findings extend beyond zoos to any organisation attempting sustainability transformation: success depends on engaging all stakeholders as partners in change rather than audiences for messaging, transparently communicating both capabilities and limitations, and ensuring that transformation reaches every operational decision rather than remaining at the strategic level.

Ultimately, through speaking each other's language and understanding different perspectives, organisations can complement one another in nature conservation efforts. By recognising each other's strengths and limitations, but most importantly our own, we can together undergo the transformation necessary to deliver positive impact on nature conservation for everyone – human, animal, and plant – within the socio-ecological ecosystem.

Figure 19: Exploring nature conservation positioning scenarios with the Zoo Nature Conservation Choice Compass and gaining insight into their operational consequences

10

This chapter reflects on the design journey of this graduation project, examining both the methodological approaches taken and the personal insights gained throughout this investigation into zoo transformation and nature conservation positioning. Rather than presenting findings, this section explores the evolving understanding of complex stakeholder dynamics, the challenges encountered in developing practical tools for organisational change, and the lessons learned about bridging academic research with real-world conservation applications. The reflection considers how initial assumptions shifted through engagement with diverse perspectives on Bonaire and within Rotterdam Zoo, and discusses the iterative process of developing the Zoo Nature Conservation Choice Compass as both a research tool and practical instrument for institutional transformation.

H10: Reflections

10.1 Process reflection

Phase 1: Problem discovery

At the start of this project, understanding the complex stakeholder landscape and identifying the real challenges facing zoos required extensive immersion in the organisational context. Through many conversations with employees from various departments and time spent at Rotterdam Zoo, it gradually became clear how interconnected zoo operations are, where heritage constraints, financial limitations, and stakeholder expectations create a complex web of considerations. The metaphor of 'sliders' that emerged during this research accurately captures how multiple variables must be balanced simultaneously. Translating this complexity into a manageable problem definition and subsequently into a simple, comprehensible solution proved to be one of the most challenging aspects of the design process.

Phase 2: Nature Conservation Practice Analysis

The Q-sort methodology employed during research on Bonaire represented entirely new territory, requiring extensive literature study to understand both the technique and accompanying factor analysis. Despite the complexity, this approach generated enthusiastic responses from participants, with some expressing interest in adopting the methodology themselves. The intensive interviews (2.5-3 hours each) resulted in enormous amounts of data that required extensive processing, but also provided deep and valuable insights into stakeholder perspectives.

What became particularly apparent throughout this phase was how willing all stakeholders were to engage in conversation and contribute to the research. From zoo staff to nature conservation stakeholders on Bonaire, they were genuinely interested in sharing their perspectives and supporting the research. These conversations proved absolutely crucial for the project's success, as they did not just provide information, but actively shaped the direction and ultimate value of the solution.

Phase 3: Solution Development

The development process included creating a fully functional board game to map complex dynamics, requiring extensive study of game mechanics and multiple prototype iterations through co-creation with employees and peers. However, the desire to create realistic representations of zoo operations resulted in excessive complexity. This phase exemplified the classic 'kill your darlings' challenge, as the project eventually had to pivot from the physical board game to a digital choice compass based on Bonaire research insights.

The design process employed extensive analogue methodologies, including idea and concept sketching on flipcharts, game prototyping and testing, making card sets to illustrate the diverse zoo activities and external events, relationship mapping through visual diagrams, and developing tables as early versions of the choice compass. This way of working proved incredibly valuable for ideation and discussing ideas with Rotterdam Zoo employees, stakeholders, and peers. The tactile nature of these materials facilitated conversations and collaborative thinking in ways that digital tools could not match.

However, this approach also created documentation challenges. The sheer volume of material produced, combined with the project's many iterations and pivots, complicated comprehensive documentation of findings. While insights and progress were recorded throughout the process, the documentation often consisted of brief notes and visual annotations rather than detailed written records. Converting all these analogue insights into a coherent digital format for the final thesis required significant effort and highlighted how more extensive written documentation alongside the visual materials would have streamlined this process.

The design decision to pivot from the board game into developing a digital choice compass presented new challenges, as this required programming skills without any prior experience. Despite the time investment and learning curve, this resulted in a functional tool that addresses stakeholder needs rather than remaining a theoretical concept.

Reflection on impact and design goal

Throughout this research, one of the most important findings was the importance of reciprocal research: not merely extracting knowledge from stakeholders, but providing tangible value in return. This principle shaped the commitment to developing a practically useful tool that zoos can directly implement and addresses their specific needs. The development of a functional digital tool enables zoo staff to immediately explore strategic scenarios, delivering practical support for institutions navigating complex transformation processes. This process reinforced the understanding that meaningful design research requires deep stakeholder engagement and commitment to delivering actionable outcomes that serve genuine organisational needs.

10.2 Personal reflection

While the methodological framework suggests a structured progression through Problem Discovery, Nature Conservation Practice Analysis, and Solution Development, the actual design process was not so linear. The reality resembled Damien Newman's design squiggle, with continuous iterative movement between phases and unexpected insights that required revisiting earlier assumptions.

A significant learning area throughout this project was distinguishing between essential and secondary information within the zoo transformation landscape. The delicate nature of this context, with its many nuances and interconnected dynamics, combined with the desire to honour all rich insights and stakeholder perspectives, sometimes made it challenging to distil complex findings into clear, actionable guidance. Moreover, the extensive stakeholder engagement and rich feedback created a strong desire to incorporate all contributions, which occasionally made prioritisation and decisive choices more challenging.

However, end users benefit more from something simple and clear rather than comprehensive complexity. This realisation led to creating something simple and actionable rather than trying to capture every nuance of the complex landscape. The pivot from board game to digital choice compass exemplified this. While the board game captured rich dynamics, the choice compass better serves users' core need to determine strategic direction. Creating a functional digital prototype without any prior programming experience required significant time investment but resulted in a practical tool that addresses genuine stakeholder needs rather than remaining theoretical.

This decision-making process directly connected to the learning objective I had stated for myself when commencing this graduation project, namely making decisive choices earlier in the process. Although considerable progress was made in this area, I recognise this remains an ongoing learning goal. Furthermore, I learned to better balance incorporating stakeholder contributions with trusting my own design expertise. Throughout this research, I discovered where my passion in design truly lies: bridging different perspectives and facilitating connections between stakeholders who might not otherwise engage, particularly in nature conservation and marine biology contexts, and I look forward to continuing this work in the future. Additionally, I developed new skills including programming, Q-sort methodology, and factor analysis that will benefit my future design practice. Despite it sometimes being challenging, I reflect positively on this project, the lessons learned, and the connections that were made along the way. These insights and experiences will guide my future work within this area, and I am excited for what is ahead!

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Appendix

Appendix A: Methodological Framework Details

A.1 Design Thinking Foundation

Design thinking is a human-centred, creative, and iterative problem-solving approach to generate innovative solutions (Brown, 2009). It integrates the needs of people, the possibilities of technology, and the requirements for business success (Brown & Katz, 2011). Viewed as a practice, design thinking provides an integrating framework that brings together both creative and analytical models of reasoning, accompanied by a process and set of tools and techniques (Liedtka, 2014). At its core, design thinking employs a systematic and practical approach to problem-solving that is both problem and solution focused. It relies on abduction and experimentation involving multiple alternative solutions that actively mediate a variety of tensions between possibilities and constraints (Liedtka, 2014). This approach is particularly well-suited to decision contexts in which uncertainty and ambiguity are high, with iteration based on learning through experimentation serving as a central task (Liedtka, 2014).

The most basic design thinking models propose a process that goes through five stages: defining the problem, analysing the problem, proposing solutions, evaluating the proposed solutions, and choosing a solution to be implemented (Smalley, 2016). Brown (2008) describes design thinking as a human-centred, creative, iterative, and practical approach to finding the best ideas and ultimate solutions, involving understanding the needs and desires of end-users through empathising, defining, ideating, prototyping, and testing.

A.2 Evolution from Double Diamond to Triple Diamond

A well-known design thinking model is the Double Diamond model, which gives a clear, comprehensive and visual description of the design process (Design Council, 2004). The two diamonds represent a process of exploring an issue more widely or deeply through divergent thinking and then taking focused action through convergent thinking. The first diamond helps people understand, rather than simply assume, what the problem is that needs to be tackled through the design process. The second diamond encourages people to give different answers to the clearly defined problem, seeking inspiration from elsewhere and co-designing with a range of different people (Design Council, 2004).

However, Marin-Garcia *et al.* (2020) argue that this framework has limited focus and lacks the ability to cover the whole set of situations faced by a process innovation team. Specifically, the Double Diamond is geared towards discovering opportunities, but does not sufficiently support structured problem solving in complex organisational settings. To address these limitations, Marin-Garcia *et al.* (2020) proposed the Triple Diamond as an extension and adaptation of the Double Diamond model. The Triple Diamond model introduces three consecutive cycles: the first to explore and prioritise issues, the second to understand causes or needs and define specific targets, and the third to generate, filter and implement solutions. Each diamond follows a divergent-convergent logic and ends with an explicit deliverable to serve as the input for the next phase (Marin-Garcia *et al.*, 2020). This makes the model comprehensive and holistic while also capable of guiding teams from problem identification through validated action (Mustafa *et al.*, 2024).

The Triple Diamond Model is a comprehensive framework for design and innovation, consisting of three main phases: **Discover, Develop, and Deliver** (Mustafa *et al.*, 2024). In the **Discover phase**, research and data collection help understand the problem and set the project's foundation. This leads to the **Develop phase**, where ideas are refined into a tangible blueprint. Finally, the **Deliver phase** rigorously tests this blueprint, ensuring the solution is practical and effective (Mustafa *et al.*, 2024). This model stresses a cyclical process, where insights from later stages refine earlier ones, ensuring a user-centred approach to innovation (Marin-Garcia *et al.*, 2020).

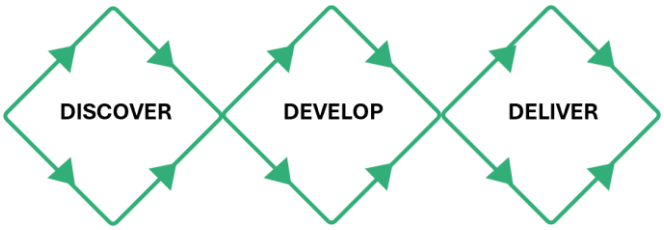


Figure A1: Visual representation of the Triple Diamond model (based on Mustafa *et al.*, 2024).

A.3 Systemic Design Framework Integration

The British Design Council developed the Systemic Design Framework to respond to increasingly interconnected challenges by integrating systems thinking into the design process (Design Council, 2021). This framework aims to help users move from reactive problem solving to proactive, long-term, and sustainable change, making it highly suitable for complex organisational transformations such as those faced by Rotterdam Zoo. Parallel to the evolution of the Triple Diamond, the British Design Council also recognised the need to adapt the Double Diamond for greater systemic relevance. The result is the Systemic Design Framework, which builds on the Double Diamond model and offers design principles and practices to help designers and non-designers work together on complex challenges (Design Council, 2021).

The framework was developed to respond to increasingly interconnected challenges such as social, economic, and environmental issues by integrating systems thinking into the design process. Furthermore, the Systemic Design Framework aims to help users move from reactive problem solving to proactive, long-term, and sustainable change (Design Council, 2021). Moreover, systemic design combines systems thinking with design methods to navigate complexity, consider multiple perspectives, and work across organisational boundaries (Design Council, 2021). Considering all of this makes the Systemic Design Framework highly suitable for complex organisational and societal transitions.

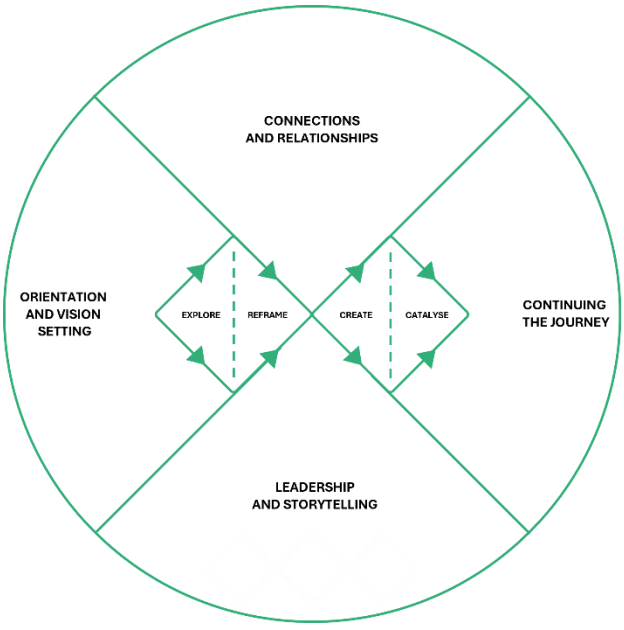


Figure A2: Visual representation of the Systemic Design Framework (based on Design Council, 2021).

A.4 Framework Integration for This Project

In this thesis, the Triple Diamond and the Systemic Design Framework were combined to form a comprehensive process model to guide the graduation project. The Triple Diamond provides a structured, iterative process to navigate from problem to action, while the Systemic Design Framework ensures that

the developed solution is embedded in a broader understanding of the system in which Rotterdam Zoo operates. This combination is particularly relevant because this project focuses on organisational culture change and sustainability – challenges that are both complex and interconnected. The Triple Diamond helps break these challenges into manageable phases and decision points (Marin-Garcia *et al.*, 2020), while the Systemic Design Framework ensures that interventions consider long-term impact, interdependencies, and stakeholder perspectives (Design Council, 2021).

While the Triple Diamond provides structure and clarity across three iterative phases, the Systemic Design Framework adds depth in dealing with complexity, long-term change, and interrelated systems. By integrating the two, this project creates a dual lens: one that ensures depth and rigour in execution through the Triple Diamond, and one that keeps attention on the system as a whole through the Systemic Design Framework. This mapping allows the two approaches to reinforce each other without conflict. In doing so, this combination enables a holistic approach, especially suitable for design challenges concerning cultural change and sustainability in organisations. In this way, the project is equipped to both deliver concrete outcomes and engage with the complexity of social, economic, and environmental challenges in a meaningful way.

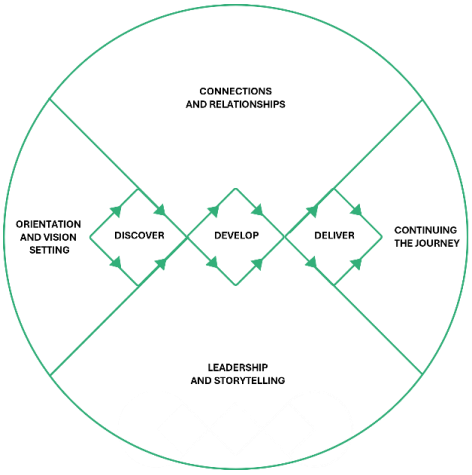


Figure A3: Integrated methodology combining the Triple Diamond model and Systemic Design Framework for this project, based on Marin-Garcia *et al.* (2020) and Design Council (2021).

A.5 Delft Innovation Model Application

The Delft Innovation Model developed by Jan Buijs (2007) provided additional structure for technology and service innovation aspects of the tool development process. This model complemented the design thinking approaches by offering specific guidance for innovation within organisational contexts.

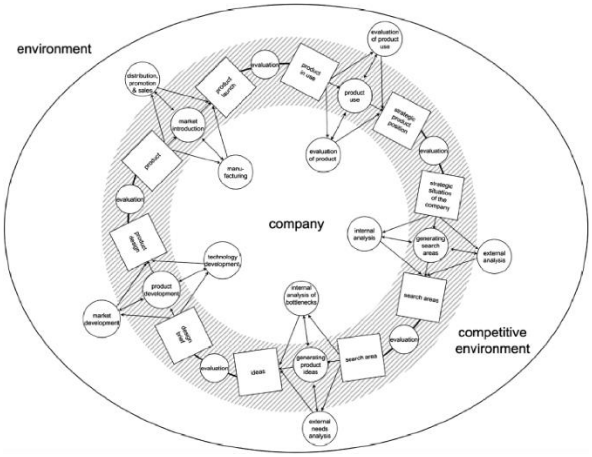


Figure A4: Visual representation of the Systemic Design Framework (based on Design Council, 2021)

Appendix B – Bonaire Research Context

Research on Bonaire

Nature conservation is an integral challenge for organisations aiming to balance ecological preservation with societal engagement. This research was conducted to support Diergaarde Blijdorp in exploring how they should position themselves in relation to nature conservation efforts. By learning from the experiences and perceptions surrounding RoffaReefs, a nature conservation programme on Bonaire, Diergaarde Blijdorp can gain insights into effective strategies for their own conservation decisions.

1. Bonaire background information insights

This appendix provides context for understanding the research findings and the complex environment in which stakeholder interviews were conducted. Bonaire's unique socio-economic, environmental, and cultural characteristics fundamentally shaped both the research process and the perspectives of interview participants.

Geographic and demographic overview

Bonaire is a Caribbean island and special municipality of the Netherlands, covering 294 km^2 (approximately half the size of Texel). The island is multilingual, with Papiamentu, Dutch, English, and Spanish as spoken languages. As of January 1, 2024, the island has a population of 25.133 inhabitants, representing significant population growth (CBS, 2024). This represents substantial growth from 2017, when the population consisted of approximately 7.000 native Bonaireans, with the remaining 12.000 residents originating from various locations, including 2.800 European Dutch nationals (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2018). This rapid population growth has contributed to increased pressure on resources, housing, and infrastructure.

The research environment

Conducting research on Bonaire requires understanding the island's unique social dynamics. The small scale means everyone knows everyone else, making personal relationships even more important for any successful initiative. Communication flows primarily through face-to-face conversations and mediums such as Facebook rather than formal institutional channels, resembling village-like information networks. This interconnected environment means research must be conducted with sensitivity to community relationships. The research process benefitted from ongoing consultation with local experts and explicit commitments to knowledge sharing. Stakeholders emphasised the importance of reciprocal research relationships, where external researchers try to provide meaningful benefits to the community rather than simply gathering information.

Economic context and nature conservation implications

Despite its status as a special Dutch municipality, Bonaire operates with the US dollar as its currency. The economic disparities between Bonaire and the Netherlands are substantial, with the minimum wage being $1,750 USD per month (€1.667,81) on Bonaire compared to €2.389,44 per month in the Netherlands, based on a 40-hour work week (Ministerie van Algemene Zaken, 2024). Food prices are exceptionally high due to the island's dependence on imports via Curaçao, as Bonaire does not have a major port, affecting operational costs for all organisations. This economic disparity has significant implications for local living conditions, with one-third of Bonaireans living in poverty and most local residents requiring multiple jobs to make ends meet (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2023). Primary income sources are tourism, salt production, and fishing. Notably, most successful businesses such as hotels, restaurants, and diving schools are owned by non-native Bonairean residents.

Nature conservation challenges

Bonaire demonstrates strong commitment to nature conservation, with the protected terrestrial area Washington Slagbaai National Park (since 1969) and marine environment Bonaire National Marine Park (since 1979), making the island one extensive nature reserve (STINAPA, 2022). However, the island faces

environmental challenges that require support and resources beyond local capacity. Recent research in 2024 documented severe water pollution surrounding Bonaire, with contamination levels increasing between 2018 and 2023 (Dossier Koninkrijksrelaties, 2024; Nu.CW, 2024). This pollution originates from multiple sources, including the BOPEC terminal, harbour activities, and waste management infrastructure limitations (Nu.CW, 2024).

Environmental management requires balancing nature conservation goals with economic realities. Introduced grazing animals create ecological pressure, yet some residents consider these animals integral to Bonaire's cultural landscape. The island also faces coral threats including coral bleaching from rising sea temperatures and Stony Coral Tissue Loss Disease (SCTLD). Moreover, heavy rainfall, combined with erosion, can result in runoff carrying pollutants into marine environments, while coral damage from cruise ships and tourists poses additional threats, despite tourism providing an essential source of income for the island. These challenges highlight the importance of well-coordinated nature conservation initiatives. Infrastructure constraints compound nature conservation challenges. Addressing issues such as waste processing, sewerage systems, and transportation infrastructure requires substantial investment and support that extends beyond local resources. This context makes effective nature conservation partnerships even more crucial for achieving meaningful environmental protection.

2. Lessons for nature conservation practice

Building trust and navigating stakeholder dynamics

The research revealed several critical insights for conservation initiatives on Bonaire and similar contexts. Personal relationships emerged as fundamental to nature conservation success, often more important than technical expertise or funding levels. Building trust and credibility requires sustained presence over several years, as short-term initiatives tend to face acceptance barriers.

The nature conservation sector on Bonaire operates within a complex network of relationships shaped by economic and social factors. Limited funding available makes collaboration between organisations both essential and competitive. The island's interconnected nature affects organisational relationships, as volunteers often engage with multiple conservation organisations simultaneously, and employees sometimes transition between different (environmental) organisations. This creates opportunities for knowledge sharing and cross-organisational learning, though it also means that personal relationships significantly influence institutional partnerships.

Nature conservation responsibility is shared between various organisations and institutions on the island, with STINAPA playing a significant role. Furthermore, many nature conservation organisations are currently managed by non-native Bonairean personnel, although they expressed growing interest in increasing local representation. Some nature organisations expressed that they identified potential differences in work approaches as considerations when exploring local employment opportunities, as these in some cases may reflect the socio-economic context of working based on immediate financial needs. This requires mutual understanding and clear expectation setting from both sides when developing thoughtful integration strategies to increase local employment and engagement within nature conservation initiatives.

Making local community engagement more inclusive

Almost all interviewed organisations expressed that local integration is important to them and have implemented various engagement approaches, primarily through public presentations, volunteer programmes, and educational activities focused on children or visitors coming to the island. These activities are mostly communicated and promoted through social media. However, current initiatives often rely on individuals coming to these organised events rather than these organisations actively coming to the people. Additionally, presentations are often hosted at locations mostly visited and owned by non-native Bonaireans, such as hotels or dive schools, which in turn often attract the same demographic: non-native Bonaireans, tourists, and external visitors. However, these venues are less inclusive of native Bonaireans, who tend to gather more in local community centres or bars and thus fall outside the scope of these initiatives. This contrasts with nature organisations' aim to engage with the local community. This approach

to location and outreach significantly influences which audiences are reached and therefore the impact on local engagement in nature conservation achieved.

There are opportunities to expand these efforts to include other demographic groups more actively and to make nature conservation more accessible to local residents by bringing initiatives to familiar community spaces and actively approaching different demographic groups. Additionally, it is important to recognise that for residents living in poverty and having to work multiple jobs to make ends meet, environmental concerns can be almost viewed as a 'luxury' when basic needs must be prioritised. This economic reality means that volunteer-based approaches may not be accessible to those already stretched across multiple income sources, which highlights the need for creating paid participation opportunities to include these demographics as well.

Research findings suggest there is a correlation between organisations with higher levels of community engagement being perceived as having greater positive impact on nature conservation, indicating potential benefits of developing more accessible and economically considerate approaches to local involvement, though further research would help establish the relation more definitively and determine whether there is causation.

Balancing nature conservation with economic and cultural realities

Additionally, successful nature conservation initiatives require balancing environmental goals with economic and cultural realities. This includes acknowledging competing pressures such as the economic importance of tourism despite its potential environmental impacts, as well as the cultural significance of practices that may have ecological consequences. Sometimes this requires adopting a business perspective to engage commercial stakeholders effectively, demonstrating financial benefits alongside environmental ones, even though many nature conservation organisations prefer intrinsic motivation for nature protection.

Finally, the research was positively received by local stakeholders, who appreciated efforts to bridge understanding between Bonaire and Dutch institutions, particularly Rotterdam Zoo. This positive reception underscores the community's desire for meaningful engagement with external nature conservation organisations, provided such engagement demonstrates genuine respect for local knowledge and long-term commitment to community benefit.

Key Insights for Conservation Practice

1. **Long-term relationship building**: Nature conservation success requires sustained personal connections and trust-building with local presence over several years rather than relying on technical solutions and short-term funding. *Invest early and consistently in relationship development across all stakeholder groups and design programmes with multi-year timelines and demonstrated local knowledge sharing.*
2. **Economic context understanding**: Limited resources create competitive dynamics among organisations that affect collaboration patterns and operational strategies. Additionally, recognising that environmental concerns can be a 'luxury' for residents working multiple jobs to make ends meet and needing to prioritise basic needs highlights the incentive to make nature conservation economically beneficial for local participants, creating value for both human and non-human ecosystems. *Acknowledge economic pressures when developing collaboration strategies and ensure nature conservation work offers tangible economic benefits and wellbeing to the local community.*
3. **Cultural bridge-building**: Success requires genuine respect for local knowledge and explicit commitments to mutual benefit rather than one-way knowledge extraction. This includes making nature conservation more accessible to everyone by choosing to host events in venues inclusive to the local community over tourist locations such as hotels and dive schools, proactively approaching these communities rather than waiting for people to come, and creating employment opportunities for native Bonaireans within nature conservation organisations. *Position external initiatives as supporting rather than leading local conservation efforts.*

Appendix C – Bonaire Research Details

C. 1 Methodology

C.1.1 Research objectives and hypotheses

The aim of this research was to analyse stakeholder perceptions on Bonaire regarding important factors in nature conservation, success factors for nature conservation initiatives, the relationship between local community engagement and positive impact on nature conservation, and important factors in collaborations. Collaboration, as highlighted in conservation literature, plays a pivotal role in the success of nature conservation projects. Examining how these partnerships are perceived and valued offers actionable insights for organisations such as Rotterdam Zoo to inform their decision-making and enhance their impact.

To identify unique and shared perspectives on nature conservation by stakeholders on Bonaire, interviews were deployed combining Q-methodology, a grid exercise, and an in-depth interview that integrated latent interview techniques with probing. Prior to conducting the interviews, three key assumptions were identified regarding the most important elements within nature conservation collaborations on Bonaire:

1. **Personal connection and collaboration:** authentic, engaged, interested, transparent, equal partnerships with mutual respect
2. **Time investment and long-term commitment:** persistence, determination, and assurance of continuity
3. **Intrinsic motivation:** genuine desire to do good, driven by enthusiasm rather than external obligations

These assumptions served as hypotheses to be tested through the conducted research.

C.1.2 Q-sort methodology overview

Origins and rationale

Q-sort methodology is a research method originally developed by British physicist-psychologist William Stephenson (1935), and subsequently elaborated and described in detail by many researchers such as Brown (1980), McKeown & Thomas (2013), and Watts & Stenner (2012). The method combines the strengths of qualitative and quantitative methods (Brown & Sell, 1984), and is designed to gain insight into human thoughts and perspectives (Lee, 2017; Zabala, 2014; Zabala *et al.*, 2018) and to explore the attitudes and subjective opinions of respondents.

Q-sort methodology is particularly well-suited to this research as it addresses a fundamental challenge in conservation practice: the need to make strategic choices when resources are limited In nature conservation, there is often a tendency to view all aspects as equally important, making it difficult to identify genuine priorities and trade-offs. The forced ranking nature of Q-sort methodology directly addresses this challenge by preventing participants from rating all conservation approaches as equally important, thereby revealing their actual priorities in decision-making processes. These insights provide valuable guidance for organisations such as Rotterdam Zoo in establishing clear priorities regarding their approach to nature conservation and determining which initiatives to pursue."

Moreover, Q-sort methodology was chosen over other decision support tools because it has proven successful at enabling researchers to discover veiled viewpoints that reveal topics of consensus, which have facilitated depolarising complex disagreements in the past (Hugé *et al.*, 2016; Lee, 2017; Zabala *et al.*, 2018). Therefore, it is instrumental in conservation research to critically reflect on the values that subliminally influence decisions and actions (Lee, 2017; Zabala *et al.*, 2018), whist providing a quantitative way to investigate subjectivity regarding biodiversity conservation (Sandbrook *et al.*, 2010; Zabala *et al.*, 2018). In addition, its ability to group narratives and participants based on statistical significance is robust

and objective, which helps to eliminate bias and identify areas of consensus of dissensus that may otherwise lack significance (Broussard *et al.*, 2023).

Q-sort methodology has been recognised and established as a valuable approach or tool in assessing environmental studies, environmental management, policy, and decision-making (Addams & Proops, 2000; Brown, 1986; Webler *et al.*, 2001), with numerous investigators using it to explore perspectives of people involved in environmental issues (e.g. Byrd, 2002; Mattson *et al.*, 2006; Steelman & Maquire, 1999). The application enables researchers to surpass mere dichotomies, add nuance, and identify areas of consensus and dissensus among stakeholders and narratives (Benitez-Capistros *et al.*, 2016), directly feeding into decision-making processes to facilitate successful implementation of biodiversity conservation management schemes (Broussard *et al.*, 2023).

Moreover, Q-sort methodology is used to assess individual's priorities about an issue and is designed to recognise the different value systems of different constituents (Brown, 1980). It was particularly developed to identify groups of respondents with similar attitudes and to analyse in detail differences in their views (Klooster *et al.*, 2008). Importantly, Q-sort studies are designed to sample from a universe of perspectives rather than a population of people (Anderson *et al.*, 1997).

How Q-sort methodology works

Q-sort methodology involves presenting a group of participating respondents (called the *P-set*) a sample of statements on a given topic (called the *Q-set*) to be ranked by the respondents on a multi-point rating continuum, where the beginning of the scale indicates the total disagreement and the end full agreement (Zawilińska *et al.*, 2023. This forced choice research approach requires all statements to be ranked without exception (Zawilińska *et al.*, 2023), with each participant asked to individually sort statements on a *Q-chart* (see Figure C4, C5, and C6) from those they most agree with to those they least agree with (Broussard *et al.*, 2023).

This procedure, referred to as a *Q-sort*, has been further refined and applied in research by, among others, Brown (1993) and Webler *et al.* (2009), and is complemented by qualitative interviews conducted during the Q-sorting process to create narratives representing different opinions and perspectives (Blicharska & Grandin, 2015).The Q-sort technique allows qualitative data to be translated into quantitative data for statistical analysis (Zawilińska *et al.*, 2023). Correlations between individual Q-sorts help identify patterns in viewpoints across participants (Blicharska & Grandin, 2015), enabling researchers to identify like-minded respondents who cluster together into *factors* through factor analysis (Broussard *et al.*, 2023). A factor is a term used to describe a small set of sorted statements that differ from others and represents the perspectives of respondents grouped within that factor (Zabala *et al.*, 2018). The analysis of the Q-sorts focuses on viewpoints rather than the population of respondents, resulting in clusters of shared subjective perspectives within a group of participants (Zawilińska *et al.*, 2023). While the analysis is of a quantitative character, the interpretation of the results remains solely qualitative (Zawilińska *et al.*, 2023).

Enhanced approach: latent knowledge and probing techniques

This study adopts an enhanced Q-sort approach to obtain deeper qualitative insights beyond standard methodology. The approach systematically integrates generative techniques to access different layers of participant knowledge.

Traditional qualitative methods such as interviews typically provide insights into knowledge that is explicit to participants, meaning what they can readily articulate and are consciously aware of. However, what people know, feel and dream (*latent* and *tacit knowledge*) often remains unexpressed in standard research approaches. Latent and tacit knowledge can be elicited through generative sessions that stimulate participants to employ their own creativity to become aware of and learn from their experiences (Gaver *et al.*, 1999; Sanders, 2001; Sleeswijk Visser *et al.*, 2005). This approach recognises that participants possess deeper layers of knowledge beyond what they can immediate articulate (see Figure C1).

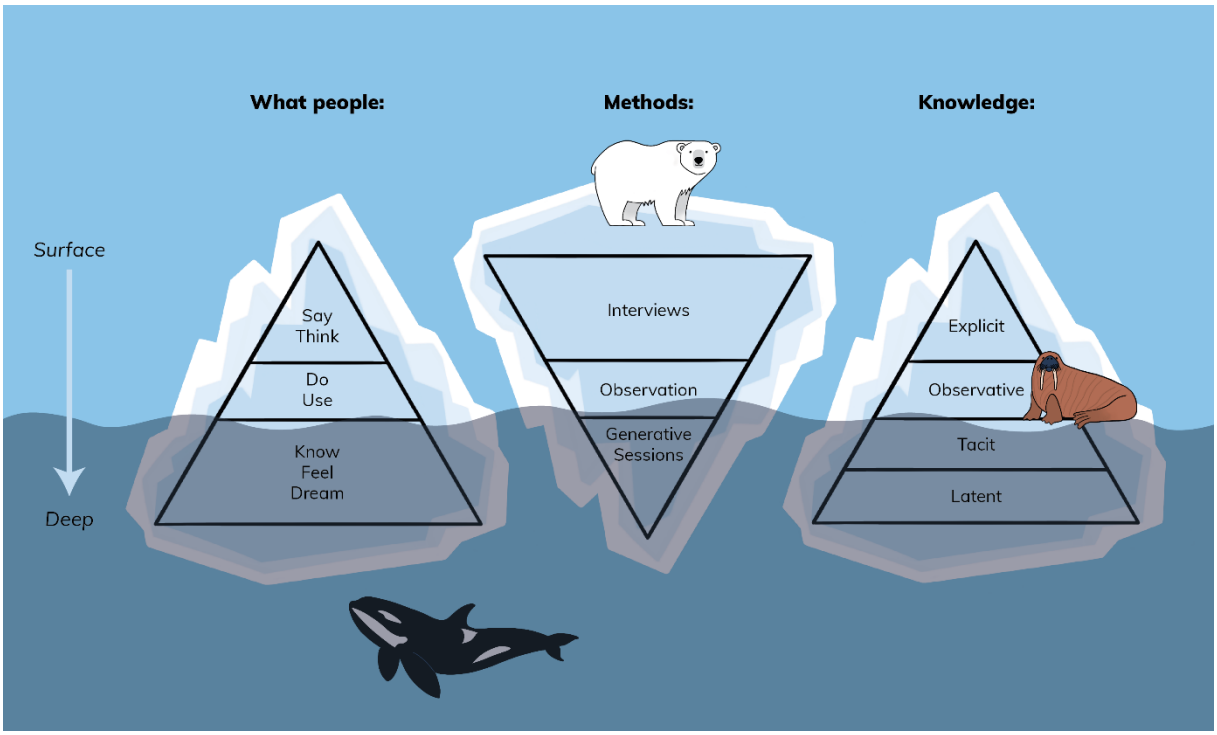


Figure C1: Different research techniques access different levels of knowledge, after Sleeswijk Visser et al. (2005).

To access these deeper knowledge layers, this research incorporates systematic probing techniques throughout the data collection process. Probes are follow-up questions or prompts used to gain more depth or clarity in a respondent's answers (Patton, 2002). Standard Q-sort methodology typically includes post-sorting interviews to understand participant's sorting choices (Brown, 1980; McKeown & Thomas, 2013). While some researchers recommend incorporating probing techniques during the sorting process (Watts & Stenner, 2012), this is not a standard component of Q-sort methodology and is often omitted in practice.

By choosing to systematically apply these probing techniques during the Q-sorting process itself, rather than relying solely on post-sorting interviews, this study aims to capture decision-making processes in real-time and reveal underlying reasoning patterns that might otherwise remain hidden. This methodological enhancement ensures comprehensive data collection while maintaining the rigour and statistical validity of traditional Q-sort analysis.

Methodological advantages of Q-sort for this study

Compared to standard questionnaires in which respondents rate each statement separately, the advantage of Q-sort methodology is its holistic nature and much greater involvement of respondents (Klooster *et al.*, 2008). Participants in the Q-sort survey have the opportunity to collate all statements and account for subtle differences in ratings, resulting in better informed opinions based on the holistic view of the issue rather than isolated evaluations (Watts & Stenner, 2012). The exploratory approach of the method and the possibility to analyse respondents' perspectives in depth make it particularly useful for understanding and describing the diversity of subjective viewpoints on an issue (Zawilińska *et al.*, 2023); in this case conservation approaches. Moreover, this approach can illustrate underlying patterns between groups or individuals that have broad shared values and can capture "the way in which meaning is organised and patterned" (Brewerton & Millward, 2001, as cited in Gruber, 2011).

C.1.3 Grid exercise methodology

The organisational mapping grid exercise was developed as a complementary tool to visually explore the relationship between local community engagement and positive impact on nature conservation. In RoffaReefs' three-pillar approach, the local pillar plays an important and evident role. Often this local pillar is overlooked within nature conservation, with people and organisations focusing primarily on nature itself and science. To investigate whether organisations with more local engagement also have greater positive impact on nature conservation, or are at least perceived as such, a grid exercise was added to the interview setup.

The grid exercise involved participants positioning logos of Bonaire-based organisations on a visual grid with community engagement on the y-axis and perceived conservation impact on the x-axis, allowing participants to spatially organise their perceptions of different organisations' approaches and effectiveness.

C.1.4 Instrument development

Research structure and process

This study was conducted sequentially according to the six-step Q-methodology process described by Broussard *et al.* (2023), McKeown and Thomas (2013), and Watts and Stenner (2012), as visually summarised in Figure C2. The steps include:

1) identification of the concourse and developing the Q-sets
2) development of the grid exercise
3) identification of study participants (P-set)
4) data collection in the form of Q-sorts
5) data collection in the form of post sorting interviews
6) quantitative analysis: factor analysis identification of distinguishable statements,
7) qualitative analysis: interpretation of data into narratives.

1) Identification of the concourse and developing the Q-sets

The development of the Q-set followed a structured and iterative process, informed by a literature review, stakeholder consultations, and practical testing to ensure its contextual relevance to Rotterdam Zoo, RoffaReefs, and the stakeholder on Bonaire.

Methodological consultation

The research design and approach were discussed in advance with representatives from relevant organisations such as Word Wide Fund Dutch Caribbean and Technical University of Delft to ensure methodological rigour and relevance. This input guided the broader structure of the study as well as the development of the different Q-sets.

Literature review and initial statement selection

The development of the Q-set began with identifying the *concourse*: the complete set of possible opinions on a subject from all viewpoints. A comprehensive literature review was conducted to identify key themes relevant to the study's core topics: nature conservation, nature conservation initiatives, the relationship between local community engagement and positive conservation outcomes, and factors influencing successful collaborations. Drawing primarily from studies on various nature conservation initiatives, review uncovered important social, financial, and emotional factors underpinning these topics that required further exploration through the Q-sort methodology.

Based on these insights, initial selections and formulations of statements were developed for each of the three Q-sorts to ensure alignment with their specific research objectives. The initial pools of statements were then clustered into thematic groups, each representing a specific dimension of the respective Q-sort's objectives. The statements within each thematic group were subsequently reviewed, refined and

condensed to create concise and coherent Q-sets that fully covered the core topics while remaining manageable for analysis.

Stakeholder consultation and contextual refinement

To expand and enrich these preliminary Q-sets and complete the concourse, additional statements were gathered through informal conversations and interviews with key stakeholders. To ensure contextual relevance, the Q-sets were reviewed and refined based on insights gained through conversations with stakeholders, including representatives from Rotterdam Zoo, RoffaReefs, Piskabon, and local experts on Bonaire, as well as knowledge derived from prior research on Rotterdam Zoo. With the assistance of these stakeholders, the draft Q-sets were reviewed to ensure the relevance of the statements in local context.

Field observations informed several methodological decisions to ensure cultural appropriateness and research ethics. Given Bonaire's small, interconnected community, statements were phrased neutrally to avoid attribution to specific organisations while capturing diverse perspectives. Moreover, these statements were formulated in English to accommodate linguistic diversity among participants. The research design incorporated commitments to knowledge sharing with participants through summarised results while maintaining individual confidentiality. Furthermore, the Q-set statements were aligned with the three pillars of RoffaReefs. Additionally, efforts were made to ensure that the statements were phrased in such a way that would capture the perspectives of relevant individuals at both Rotterdam Zoo and RoffaReefs on the topics of this study, enabling a comparison with the views of stakeholders on Bonaire.

Testing and final refinement

Following this development process, the draft Q-sets were further reviewed and tested with a local expert on Bonaire to ensure clarity and to avoid potential misinterpretations. Additionally, potential cultural sensitivities were addressed to the statements were appropriate and respectful in the specific local context. This systematic and iterative process resulted in scientifically grounded and contextually relevant Q-sets, well-suited to explore stakeholder perspectives on Bonaire.

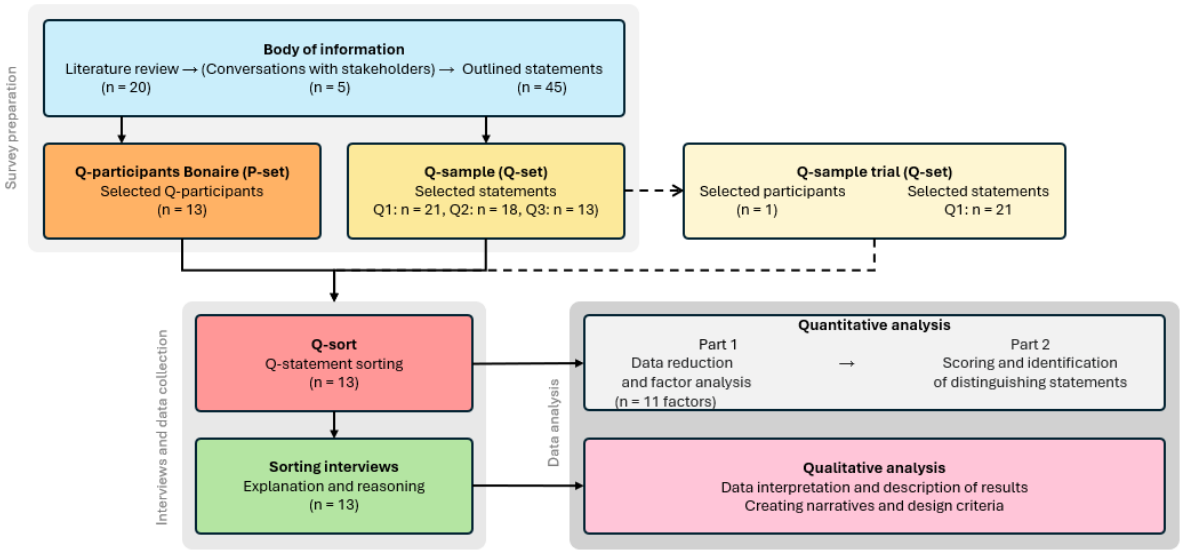


Figure C2: Visual diagram illustrating the Q-methodology research procedure for this study, adapted from Zabala et al. (2018).

2) Development of the grid exercise

The organisational mapping grid exercise was developed as a complementary tool to visually explore the relationship between local community engagement and positive impact on nature conservation. Organisations active on Bonaire were selected based on their relevance to nature conservation and their varying approaches to community involvement. The grid structure positioned community engagement on

the y-axis and perceived conservation impact on the x-axis, allowing participants to spatially organise their perceptions of different organisations' approaches and effectiveness.

3) Identification of study participants (P-set)

The aim was to collect the most diverse range of opinions possible (Zabala *et al.*, 2018). For the P-set, a list of organisations was compiled that are either stakeholders of Diergaarde Blijdorp and RoffaReefs or that play a role, directly or indirectly, in nature conservation on Bonaire. These include NGOs, commercial enterprises, an environmental consultancy group, a fisheries cooperative, and a volunteer-based foundation. The diversity of these organisations ensures a broad and representative range of perspectives on the topics in this Q-sort methodology study. A total of 12 different organisations and 13 individuals participated in this study (see Figure C3).

Figure C3: Overview of the P-set

C.1 Data collection process

4) Data collection in the form of Q-sorts and post sorting interviews

The survey was conducted in November 2024 on Bonaire. Data were collected through in-person interviews, and the survey was administered exclusively by the author of this thesis. The Q-sort methodology survey consisted of three stages, with the same structure consistently applied to all three Q-sorts (Q1, Q2, Q3) and followed by the grid exercise to ensure comprehensive and unbiased data collection.

Phase 1: Q-sort activities

- **Preliminary sorting:** respondents were asked to freely sort all Q-set statements for each Q-sort, placing them in their preferred order without restrictions on the number of statements that could be assigned to each position on the grid. This allowed participants to express their preferences and opinions without constraints.
- **Sorting statements on the Q-grid:** secondly, respondents were asked to sort the statements onto the response grid, where the left end (-2) indicated 'least important' and the right end (2) 'most important'. This process was repeated for each of the three Q-sorts. The layout of the three Q-sorting grids is shown in Figures C4, C5 and C6.

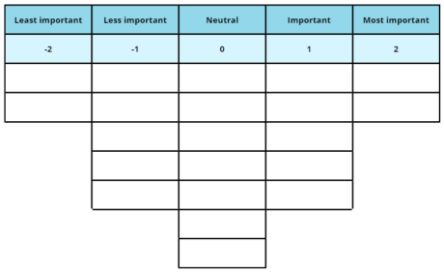


Figure C4: Q-grid for Q-sort 1: Important factors for successful nature conservation

Least important	Less important	Neutral	Important	Most important
-2	-1	0	1	2

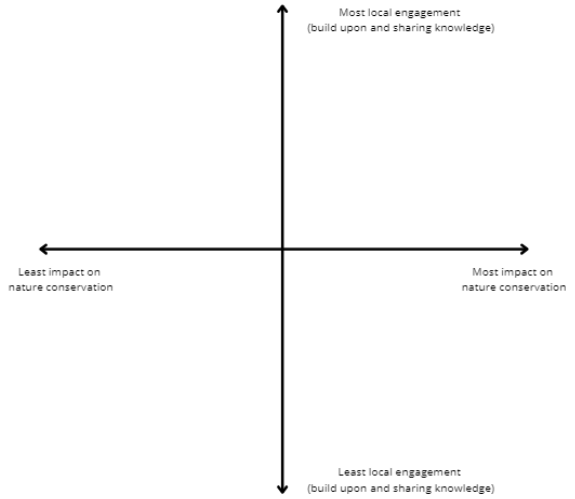
Figure C5: Q-grid for Q-sort 2: Important factors for success of nature conservation initiatives such as RoffaReefs

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
-2	-1	0	1	2

Figure C6: Q-grid for Q-sort 3: Important factors in successful collaborations

Phase 2: Grid exercise

Following the completion of all three Q-sorts, participants engaged in the organisational mapping exercise, positioning logos of Bonaire-based organisations on a grid according to their perceived levels of community engagement and positive conservation impact.



5) Data collection in the form of Q-sorts and post sorting interviews

Phase 3: Post-sorting discussion

Upon completion of all Q-sorts and the organisational mapping exercise, participants engaged in a structured discussion to provide additional commentary on their placement choices. This discussion focused on reviewing statements and organisations that participants had found particularly challenging to place, as well as any final reflections on their sorting decisions. Participants were invited to elaborate on any aspects they felt required further explanation or clarification, ensuring that their perspectives were fully captured and understood. This discussion served to address any remaining ambiguities and provided an opportunity for participants to refine or expand upon their earlier explanations.

Phase 4: In-depth semi-structured interview

The final phase consisted of a comprehensive semi-structured interview exploring broader themes related to participants' professional backgrounds, organisational contexts, and perspectives on nature conservation and collaboration on Bonaire. Key topics included participants' roles and experiences within their organisations, their organisations' approach to nature conservation and community engagement, challenges encountered in collaborative efforts, and their views on effective nature conservation strategies. The interview also explored participants' perceptions of the current nature conservation landscape on Bonaire, including relationships between different stakeholders and opportunities for improved collaboration. Furthermore, the participants were asked what future role they envisioned for both Diergaarde Blijdorp and RoffaReefs, both in general and specifically on Bonaire. This phase provided essential contextual information to interpret the Q-sort and organisational mapping results within the broader framework of each participant's professional experience and organisational perspective.

Probing techniques implementation

This research incorporates systematic probing throughout the entire data collection process, recognising that participants' decision-making processes require careful exploration to understand their rationale. The probing approach was implemented through real-time observation and questioning during all data collection activities (Q-sorting and organisational mapping), ensuring methodological rigour through four complementary phases and different data collection methods.

During each activity, participants were observed and asked supporting questions to explore and understand their reasoning and decision-making processes. This observational approach allowed for real-time exploration and immediate clarification of these thought processes and underlying motivations while choices were being made, rather than relying on post-hoc explanations. Non-verbal cues, body language, and hesitation were also monitored throughout the Q-sorting and organisational mapping processes. Participants were encouraged to elaborate whenever uncertainty or internal conflict was observed. This observational component provided additional insights into the complexity of decision-making processes that purely verbal responses might not capture. Probing questions were strategically deployed to encourage participants to elaborate on their reasoning. The questioning approach was designed to be non-directive, emphasising that there were no right or wrong answers. The objective was to explore underlying reasoning without guiding or influencing participant responses.

This systematic probing approach was consistently applied across all three Q-sorts and the organisational mapping exercise, with participants asked to explain their placement decisions for both Q-sort statements and organisational logos. In order to better understand differences in respondents' assessments (Zawilińska, et al., 2023), and following Klooster *et al.* (2008), respondents were invited to comment on all statements after completing each Q-sort, with particular emphasis on those placed in extreme positions (e.g. most important or least important). Similarly, during the organisational mapping exercise, participants were asked to elaborate on their positioning choices for each organisation on the grid. By asking participants to explain their reasoning behind the ranking of statements, deeper insights can be gained into why certain aspects are considered more or less important, contributing to the revelation of tacit knowledge and hidden thoughts (Sleeswijk Visser *et al.*, 2005).

Finally, participants engaged in a semi-structured in-depth interview, enabling a better understanding of their motives and gaining insights into their own organisations' relation to nature conservation and local community engagement. This combination of Q-sort methodology, organisational mapping, probing questions, and supportive in-depth interview ensured that this study was conducted with methodological rigour. The implementation of this enhanced Q-sort approach ensured that both explicit placement choices and the underlying reasoning behind these choices were systematically documented across all activities, providing rich qualitative data to complement the quantitative Q-sort analysis.

C.2 Interview results

The research consisted of four main components:

- **Q-sort 1:** Important factors for successful nature conservation
- **Q-sort 2:** Important factors for success of nature conservation initiatives such as RoffaReefs
- **Grid exercise:** Organisational mapping examining the relationship between community engagement and positive nature conservation impact
- **Q-sort 3:** Important factors in successful collaborations

C.2.1 Results Q-sort 1: Important factors for successful nature conservation

Score	Number	Statements Q1: Nature Conservation
1,23077	N8	N8. Long-term goals and sustainable strategies are essential for the success of nature conservation.
1,15385	N11	N11. Successful nature conservation must build on the existing knowledge and expertise of the local community and involve collaborations with local stakeholders.
1	N12	N12. Effective and transparent communication among stakeholders is essential for successful nature conservation.
0,84615	N9	N9. Local presence of the organisations wanting to contribute to nature conservation is vital for the success of the conservation initiatives.
0,61538	N20	N20. Community engagement strengthens the effectiveness of nature conservation initiatives.
0,53846	N17	N17. An entrepreneurial attitude is important in nature conservation, as proactive leadership ensures accountability and drives collaborative action in conservation efforts.
0,38462	N1	N1. Nature conservation will only be successful if the local community is actively involved and engaged in all decision making processes.
0,30769	N16	N16. Nature conservation initiatives must always be scientifically backed to ensure and enhance their effectiveness.
0,23077	N3	N3. Nature conservation contributes to community well-being.
0,23077	N18	N18. Knowledge and findings regarding nature conservation should always be shared to the public and stakeholders involved.
0,07692	N19	N19. Community knowledge enriches scientific research and contributes to effective conservation efforts.
-0,07692	N2	N2. Nature conservation is only viable if it delivers benefits to the local community.
-0,15385	N15	N15. We do not fully understand how ecosystems function, so we must preserve them to avoid unforeseen consequences if they fail.
-0,23077	N10	N10. Intrinsic motivation to protect nature is the most important factor for successful conservation.
-0,30769	N14	N14. Nature conservation is successful if it contributes to the survival of specific species.
-0,38462	N13	N13. Nature conservation should always aim to save entire ecosystems.
-0,69231	N4	N4. Achieving rapid positive results is crucial for the success of nature conservation efforts.
-0,76923	N5	N5. Nature conservation should enhance tourism opportunities rather than limit them.
-1,07692	N6	N6. Nature conservation is only viable if it drives economic growth.
-1,15385	N7	N7. In nature conservation, quick wins are more important than long term goals because they provide immediate successes.
-1,76923	N21	N21. Contributing to nature conservation is solely important to avoid legal consequences.

Table C.1: Q-sort 1 overall priority ranking

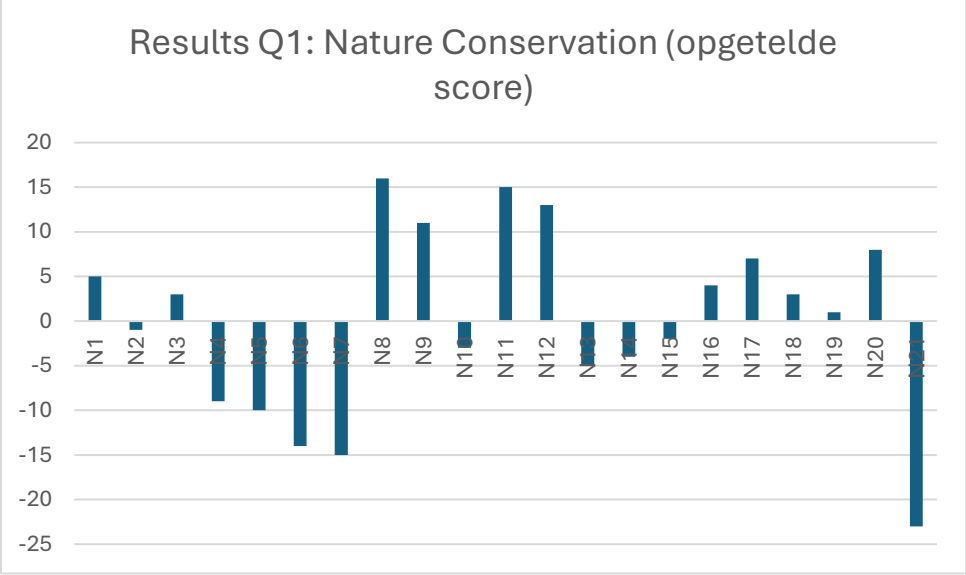


Figure C7: Q-sort 1 composite score

Factor analysis Q-sort 1: Three perspectives identified

Factor 1: Collaborative Community-Engaged Conservationists (10 organisations) Core philosophy: This factor represents organisations that prioritise collaborative, community-engaged approaches to nature conservation with a strong emphasis on long-term strategic planning and transparent communication. Key characteristics include a community-centric approach where effective and transparent communication among stakeholders is essential for successful nature conservation, long-term strategic focus prioritising sustainable strategies over quick wins, knowledge integration that values building on existing local knowledge and expertise, and explicit rejection of conservation approaches driven primarily by economic growth or legal compliance. Distinguished by strong support for community engagement while maintaining a balanced approach to conservation targets, viewing both ecosystem and species-specific conservation as valid depending on context and stakeholder input.

Factor 2: Community-Centric Pragmatic Localists (2 organisations) Core philosophy: This factor represents a pragmatic approach that strongly emphasises local community involvement and benefits while maintaining scepticism towards purely scientific or long-term strategic approaches. Key characteristics include community primacy with the strongest position on mandatory community involvement in all decision-making processes, knowledge democratisation that values community knowledge and intrinsic motivation to protect nature, scientific scepticism that distinctively rejects the primacy of scientific backing for conservation initiatives, and strategic flexibility showing less enthusiasm for long-term strategies compared to other factors. Distinguished by strong emphasis on mandatory community involvement and rejection of scientific backing as a primary requirement for conservation initiatives.

Factor 3: Entrepreneurial Leadership-Driven Conservationists (1 organisation) Core philosophy: This factor represents an approach that emphasises strategic leadership, entrepreneurial attitudes, and ecosystem-focused conservation while maintaining distance from community-driven processes. Key characteristics include leadership-driven conservation that strongly emphasises entrepreneurial attitudes and proactive leadership, ecosystem conservation with societal alignment that prioritises ecosystem conservation over species-specific approaches, and community distance that rejects the necessity of community involvement in all decision-making processes. Distinguished by strong emphasis on entrepreneurial leadership and rejection of mandatory community involvement, representing a more top-down, strategically driven approach to nature conservation.

Consensus and Tensions

All factors demonstrate strong consensus in rejecting legal compliance as primary motivation and inappropriate economic drivers, while showing fundamental tensions around community involvement requirements, scientific validation standards, and conservation target philosophy (species vs ecosystem focus).

C.2.2 Results Q-sort 2: Important factors for successful nature conservation initiatives such as RoffaReefs

Score	Number	Statements Q2: Nature Conservation Initiatives
1,2307692	R8	The attitude and skills of the RoffaReefs team are vital for building fruitful collaborations, requiring respect, openness, and genuine interest in learning from the local community.
1	R11	RoffaReefs must build and share knowledge within collaborations with local stakeholders, utalising the local community's expertise to achieve meaningful outcomes.
0,6923077	R2	The local presence of RoffaReefs staff on Bonaire is essential for effective collaboration in conservation efforts, ensuring ongoing support, engagement, and investment in the local community.
0,6153846	R16	In order to be successful, RoffaReefs must maintain a stable workforce of dedicated employees to ensure continuity in conservation efforts and strengthen partnerships.
0,3846154	R1	The personal connections of RoffaReefs with other organisations are crucial for its success in conservation efforts.
0,3076923	R7	Integrity and genuine commitment to doing good are essential for building successful partnerships and crucial for lasting success of RoffaReefs.
0,2307692	R3	In order to be successful, RoffaReefs must commit to a long-term relationship with local stakeholders that genuinely contribute to the Bonairean community and foster sustainable development.
0,2307692	R12	Ensuring an equitable collaboration with shared goals and benefits between RoffaReefs and local stakeholders is essential to the success of RoffaReefs.
0,0769231	R9	The complementarity of the RoffaReefs initiative with existing nature conservation initiatives is key to its overall success.
-0,1538462	R17	RoffaReefs has a positive impact on Bonaire.
-0,3076923	R5	On Bonaire, we are proud to have an initiative as RoffaReefs.
-0,3076923	R10	The expertise, ideas and resources that RoffaReefs brings to Bonaire are unique and indispensable, delivering essential conservation solutions that no other organisation can provide.
-0,3076923	R14	RoffaReefs' success does not depend on its connection to Diergaarde Blijdorp and could thrive with support from any organisation or independently.
-0,3076923	R18	For RoffaReefs, taking entrepreneurial initiative is crucial to ensure accountability and drive collaborative action in conservation efforts.
-0,4615385	R6	RoffaReefs will only be successful if it hires Bonairean employees, fostering local engagement and ownership in its initiatives.
-0,5384615	R4	For RoffaReefs to achieve lasting success, it must eventually be managed and integrated by a Bonairean organisation in the future.
-1,0769231	R13	The brand recognition and reputation of Diergaarde Blijdorp make partnering with RoffaReefs more attractive by enhancing credibility and increasing visibility for organisations.
-1,3076923	R15	RoffaReefs will be successful if collaborating organisations see clear financial benefits and support through the partnership.

Table C.2: Q-sort 2 overall priority rankings

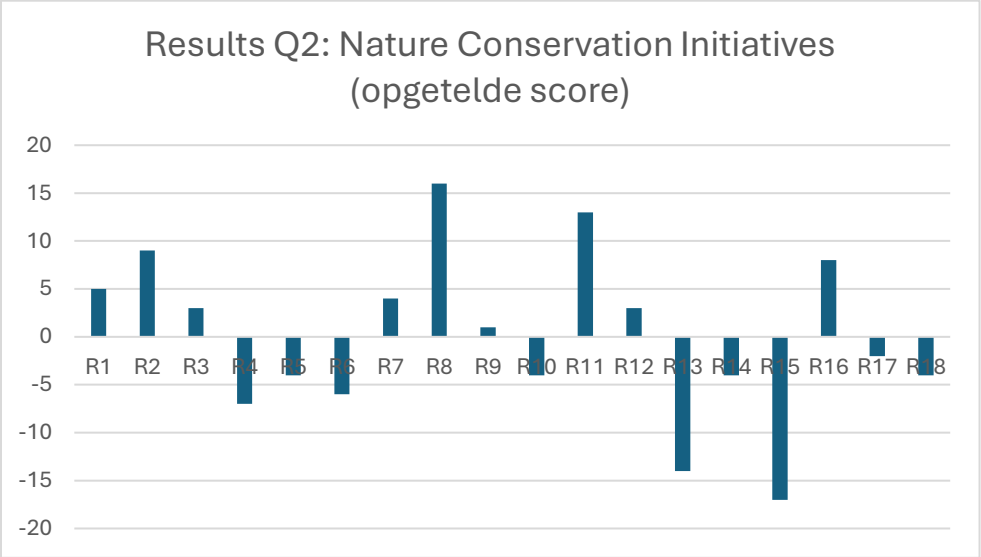


Figure C8: Q-sort 2 composite score

Factor Analysis: Three Perspectives Identified

Factor 1: Collaborative Pragmatists (6 organisations) Core philosophy: Stakeholders who prioritise collaborative approaches to conservation while maintaining realistic expectations about organisational dynamics and partnership effectiveness. Key characteristics include a partnership-centric approach strongly emphasising knowledge sharing and building partnerships, pragmatic realism demonstrating measured scepticism towards financial motivations and brand-driven collaborations, moderate local integration taking balanced stance on local hiring and management without prescriptive approaches, and process over structure showing neutral positioning on entrepreneurial initiative and organisational independence. Distinguished by strong emphasis on knowledge building and team attitude as highest priorities, combined with consistent rejection of financial and brand-driven motivations.

Factor 3: Community-Centric Idealists (2 organisations) Core philosophy: Stakeholders who prioritise authentic community engagement and long-term local integration above all else, viewing conservation success through genuine commitment to local communities. Key characteristics include authenticity-driven approach ranking integrity and long-term community relationships as most important, anti-entrepreneurial stance showing scepticism towards business-oriented conservation models, independency advocacy supporting RoffaReefs'

potential independence while favouring eventual local management, and strategic community focus showing less enthusiasm for immediate collaborative processes while focusing on authentic long-term commitment. Distinguished by strong emphasis on authentic commitment and community integration combined with systematic rejection of entrepreneurial approaches.

Factor 4: Competence-Focused Pragmatists (5 organisations) Core philosophy: Stakeholders who prioritise demonstrable competence and effective implementation over idealistic goals, brand recognition, or partnership rhetoric. Key characteristics include excellence-driven emphasis on team quality and knowledge building, critical impact assessment maintaining high evidential standards for claiming conservation success, competence over demographics prioritising effectiveness over demographic considerations in hiring and management, and substance over symbolism showing nuanced evaluation while maintaining scepticism about financial motivations. Distinguished by critical assessment of claimed positive impacts with strong emphasis on demonstrable competence, representing a results-oriented approach demanding evidence over aspirational statements.

Consensus and Tensions
Universal rejection of financial motivations and brand-driven partnerships, with tensions around community engagement philosophy, expertise versus local knowledge, and entrepreneurial approaches to conservation work.

C.2.3 Results Q-sort 3: Important factors in successful collaborations

Score	Number	Statements Q3: Collaborations
1,307692	C3	To gain access to networks and connections.
0,692308	C7	To gain knowledge, experience and new insights.
0,692308	C2	To receive financial resources.
0,384615	C4	To receive training and development resources.
0,076923	C11	That my organisation's contributions are recognised and acknowledged.
-0,15385	C10	To maintain its own identity.
-0,15385	C12	To take a leadership role, driving initiatives instead of being led.
-0,23077	C5	To receive cultural resources.
-0,30769	C8	To receive employees and/or volunteers to strengthen our workforce.
-0,46154	C9	To receive communication and awareness resources.
-0,53846	C13	To establish long-term collaborations as short-term partnerships are not effective to reach our goals.
-0,61538	C6	To gain access to technology.
-0,69231	C1	To receive material resources.

Table C.3: Q-sort 3 overall priority rankings

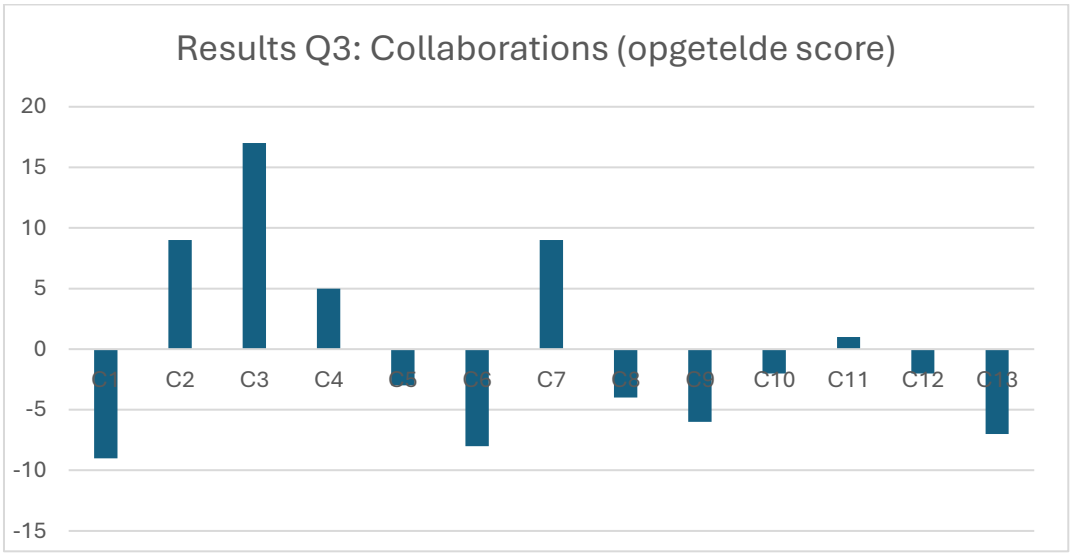


Figure C9: Q-sort 3 composite score

Factor Analysis: Five Perspectives Identified

Factor 1: Network-Driven Knowledge Seekers (3 organisations) Core philosophy: Organisations that prioritise strategic network building and knowledge acquisition while maintaining measured approach to resource dependency. Key characteristics include strategic network building placing exceptional importance on gaining access to networks and connections, knowledge-centered approach highly valuing knowledge and experience gained through partnerships, balanced resource perspective showing moderate interest in financial resources without desperation, and selective resistance distinctly rejecting dependence on material resources and technology access. Distinguished by exceptionally high valuation of network access and rejection of material resource dependency.

Factor 2: Knowledge-Driven Capacity Builders (2 organisations) Core philosophy: Organisations emphasising knowledge acquisition and recognition while maintaining independence from traditional resource dependencies. Key characteristics include dual emphasis on gaining knowledge and ensuring contributions are recognised, resource independence showing resistance to financial dependency, leadership avoidance strongly rejecting taking leadership roles, and workforce rejection preferring to maintain organisational structure. Distinguished by combination of knowledge-seeking with recognition-seeking while rejecting financial dependency and leadership responsibility.

Factor 3: Resource-Dependent Partnership Builders (3 organisations) Core philosophy: Organisations prioritising financial security and material resources while showing complex relationships with autonomy and leadership. Key characteristics include financial priority placing primary importance on receiving financial resources and recognition, material resource rejection paradoxically rejecting material dependency while seeking financial support, leadership engagement showing moderate interest in taking leadership roles, and long-term resistance rejecting importance of establishing long-term collaborations. Distinguished by combination of financial seeking with recognition needs while rejecting long-term commitment.

Factor 4: Action-Oriented Leadership Developers (1 organisation) Core philosophy: Distinctive approach prioritising practical capacity building and leadership development while maintaining minimal concern for identity preservation. Key characteristics include training and development focus placing exceptional emphasis on receiving training resources, leadership commitment strongly prioritising taking leadership roles, communication enhancement showing particular interest in communication resources, and strategic pragmatism rejecting both recognition-seeking and long-term collaboration commitment. Distinguished by unique combination of training focus with leadership ambition while rejecting identity preservation.

Factor 5: The Autonomy-Dependency Divide (4 organisations - bipolar factor) Core philosophy: This factor captures a fundamental tension between resource-focused external engagement versus autonomy-preserving selective partnership. The positive pole represents organisations willing to prioritise external capacity building over autonomy, emphasising knowledge and workforce strengthening while showing flexibility in identity and leadership positioning. The negative pole represents organisations insisting on maintaining autonomy and leadership while engaging selectively in strategic alliances, preferring partnerships that complement rather than change core operations. Distinguished by fundamental philosophical divide about whether organisations should prioritise accessing external resources through flexible partnerships or maintain autonomy while selectively engaging in strategic alliances.

Consensus and Tensions

Universal emphasis on knowledge acquisition as foundation for collaboration, with critical tensions around leadership roles, autonomy versus dependency, temporal orientation conflicts, and financial resource philosophy creating both strategic risks and opportunities for partnership coordination.

C.2.4 Cross Q-sort analysis: overall conclusions

Analysing patterns across all three Q-sort exercises reveals several overarching insights about nature conservation practice on Bonaire:

Consensus Themes Across All Q-sorts:

- Local engagement and empowerment emerge as crucial for sustainable success of nature conservation initiatives across all stakeholder perspectives
- Knowledge sharing and capacity building consistently strengthen long-term impact, appearing as universal priorities regardless of organisational philosophy
- Strategic partnerships must be based on shared goals rather than economic or promotional incentives, with financial motivations consistently rejected across all exercises

Critical Gaps Identified:

- The human ecosystem is often overlooked in nature conservation approaches, despite its fundamental importance to conservation success
- There is a need to bridge the gap between Bonaire and the Netherlands (Rotterdam Zoo), with RoffaReefs sometimes functioning as that bridge by engaging with local stakeholders
- Rotterdam Zoo must clearly define its role within nature conservation to establish effective partnerships and avoid unclear expectations among stakeholders These cross-cutting themes demonstrate remarkable consistency in stakeholder priorities despite philosophical differences in implementation approaches.

C.2.5 Results grid exercise

The organisational mapping grid exercise examined the perceived relationship between local community engagement and positive conservation impact among Bonaire-based organisations. Participants positioned logos of conservation-related organisations on a grid with community engagement on the y-axis and perceived conservation impact on the x-axis.

Key Findings: The exercise revealed varying levels of participant familiarity with different organisations, with insider knowledge creating more nuanced positioning for familiar entities while unfamiliar organisations were often positioned centrally as 'neutral'. Organisations maintaining close collaborative relationships tended to receive higher conservation impact scores, suggesting that visibility and partnership networks influenced perceptions of effectiveness. The results indicated potential correlation between active community engagement and perceived conservation impact, though interpretive ambiguities emerged around defining meaningful local engagement and whether it necessarily correlates with conservation effectiveness. Furthermore, the grid exercise results indicate that the position of Rotterdam Zoo and RoffaReefs within Bonaire's conservation landscape still requires definition. While good intentions are visible among stakeholders, their institutional positioning needs to take clearer shape to enable accurate assessment of their impact on nature conservation.

Methodological Considerations: The subjective nature of positioning decisions without standardised criteria, varying participant knowledge levels, and temporal bias toward historical rather than current performance represent important limitations in interpreting definitive relationships between community engagement and conservation impact.

C.2.5 Key interview insights: critical success factors

Beyond the formal Q-sort and grid exercise results, the in-depth interviews validated initial research assumptions and revealed three fundamental elements underlying successful nature conservation collaborations on Bonaire:

1. Personal connection and authentic collaboration: Successful partnerships require genuine involvement, transparency, equality, and mutual respect between partners. Personal relationships emerged as fundamental to conservation success, with connections often being person-based rather than organisationally anchored. Different organisational types approach conservation differently: NGOs typically focus on natural ecosystems, while commercial entities incorporate business perspectives considering human ecosystem dynamics.

2. Time investment and long-term commitment: Effective conservation demands sustained engagement, persistence, and assurance of continuity rather than short-term interventions. Stakeholders identified a need for clearer strategic direction from Rotterdam Zoo regarding long-term conservation commitments. Clear communication about sustained goals would benefit partnership development and organisational credibility, while measurable impact communication remains crucial for demonstrating value.

3. Intrinsic motivation and enthusiasm: Authentic conservation work stems from genuine desire to make positive impact rather than external obligations. The consensus suggests RoffaReefs demonstrates positive intentions rooted in genuine desire for impact, with stakeholders adopting a wait-and-see approach regarding long-term contribution. Stakeholders expressed appreciation for efforts to bridge understanding between Bonaire and Dutch institutions.

These insights emerged consistently across interviews, demonstrating alignment between assumptions and empirical results while revealing broader themes around local integration challenges, governance dynamics, and organisational positioning that provide crucial context for interpreting the quantitative Q-sort findings.

Appendix D – Operational Framework Zoo Nature Conservation Scenarios

Category	Elements
Organisational Identity and Mission	• Primary strategic organisational objective • Ethical positioning • Approach to local based solutions • Approach to science based solutions • Approach to nature based solutions • Total impact on nature conservation
Internal Operations and Delivery	• Animal collection approach • Animal welfare and care standards • Zoo design and facilities approach • Educational function and impact • Sustainability and environmental impact approach • Staff and competencies approach (informational) • Technology and innovation approach (informational)
External Relations and Perception	• External communication and PR approach • Visitor profiles and experiences approach (informational) • Partnerships and collaboration approach (informational) • Public perception and societal support approach (informational)
Viability and Resilience	• Financial viability approach (informational) • Approach to legislation and compliance (informational) Crisis management and adaptability approach (informational)

Note: Elements marked as "informational" represent consequential factors beyond immediate organisational control, derived from game design insights regarding external events.

Appendix E – Theory of Change Framework

Core Components of Theory of Change

A comprehensive Theory of Change framework maps change processes through five sequential components that form a causal pathway:

- **Inputs/resources:** represent the foundational assets and capabilities that organisations possess or can access (GSS, n.d). Inputs are required for implementation, including financial capital, human expertise, institutional knowledge, and physical infrastructure, technological systems, partnerships, and organisational reputation that provide the fundamental capacity for initiating change processes and enabling enable activities to occur (Consultivo, 2025).
- **Activities:** represent the concrete actions undertaken by the programme or organisation. These are the interventions, research projects, educational programmes, or other initiatives that transform organisational resources into purposeful actions that form the foundation of the change process (Belcher *et al.*, 2024).
- **Outputs:** are the direct products of these activities – what the programme produces or delivers. In organisational contexts, outputs might include new knowledge, services, technologies, institutional arrangements, policy recommendations, and other tangible deliverables or innovations developed to address identified challenges and take advantage of opportunities (Belcher *et al.*, 2024).
- **Outcomes:** represent observable changes in behaviour or actions of other system actors resulting from outputs. These intermediate changes demonstrate that the outputs are being utilised and adopted through various social processes, indicating real-world application and stakeholder engagement beyond simple delivery or knowledge creation (Belcher *et al.*, 2024).
- **Impacts:** constitute the ultimate, mission-level changes that the initiative aims to achieve. The ToC acknowledges that research or organisational interventions alone cannot directly cause these high-level impacts in complex systems, but can make substantial contributions through the logical pathway of leveraging resources as inputs, activities to produce outputs that generate outcomes leading to broader impacts (Belcher *et al.*, 2024).

Appendix F – Project Brief

TU Delft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	Grommers 7310
Initials	S. A. M.
Given name	Sanne Anke Maria
Student number	4659759

IDE master(s)	IPD ☐ Dfl ☐ SPD ✔
2nd non-IDE master	
Individual programme *(date of approval)*	
Medisign	☐
HPM	☐

SUPERVISORY TEAM

Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Prof. Dr. Ir. Jan Carel Diehl	dept./section	Design for Sustainability
mentor	Ir. Willemijn Brouwer	dept./section	Design, Organisation and Strategy
2nd mentor	Tim van Wagensveld		
client:	RoffaReefs, Diergaarde Blijdorp		
city:	Rotterdam	country:	The Netherlands
optional comments			

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in **by the Chair** of the supervisory team

Sign for approval (Chair)

Jan-Carel Diehl

Digitally signed by Jan-Carel Diehl
Date: 2024.09.02 07:20:36 +02'00'

Name	JC Diehl	Date	2 Sep 2024	Signature	

CHECK ON STUDY PROGRESS

To be filled in **by SSC E&SA** (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total _____ EC

Of which, taking conditional requirements into account, can be part of the exam programme _____ EC

★	**YES**	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

Rik Ledoux
2024.09.04
15:18:01 +02'00'

Name Rik Ledoux Date 4 Sep 2024 Signature

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	★	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is ...

★	**ALLOWED** to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Monique von Morgen
Digitally signed by Monique von Morgen
Date: 2024.09.05 10:31:15 +02'00'

Name Monique von Morgen Date 5 Sep 2024 Signature

Personal Project Brief – IDE Master Graduation Project

Name student Sanne Grommers **Student number** 4,659,759

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title A Strategic Framework for Blijdorp's National and International Nature Conservation and Restoration Strategy

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

Worldwide, wildlife populations are declining due to habitat destruction and climate change. The Living Planet Index (LPI) reveals an average 69% decrease in monitored wildlife populations since 1970 (World Wildlife Fund, 2022).
Stichting Koninklijke Rotterdamse Diergaarde (Rotterdam Zoo) aims to reverse this trend trough nature conservation and restoration, aiming to expand its impact both nationally and internationally. Aligned with its mission, "together we bring nature back to life", the zoo established a Nature Conservation, Education, and Research (NEO) department in 2021. Additionally, Diergaarde Blijdorp actively participates in breeding and population management programs (EEP and GSMP), aiming to maintain healthy reserve populations of animals within zoos (ex situ conservation). There is also a strong commitment to integrate these programs with conservation efforts in the species' native habitats (in situ conservation).

In its Masterplan 2050, Diergaarde Blijdorp has set ambitious goals to actively contribute to global biodiversity conservation. Recognising that it cannot save every species, Blijdorp aims to restore ten endangered species from the IUCN Red List, referred to as the TEN or the ten impact species, along with their habitats across eight key regions worldwide, known as the impact areas. The initiatives are guided by six pillars - animal welfare, research, cultural heritage, sustainability, audience, and education - collectively shaping its efforts towards holistic conservation and public engagement. Additionally, Blijdorp emphasises the importance of targeted ecosystem restoration for the survival of its impact species and plans to enhance in situ conservation by creating 'Blijdorp Hubs' in impact regions such as the Caribbean Coast (the Caribbean Hub in Bonaire) and the Himalayan Peaks (a Blijdorp Hub in Nepal).
RoffaReefs, an initiative led by Diergaarde Blijdorp and key project within the Caribbean Hub, aims to strengthen the natural fish population and support coral reef restoration in Bonaire. This project, illustrated in the Masterplan 2050 with the surgeonfish as one of the ten impact species, exemplifies Blijdorp's broader conservation strategy. Establishing these 'Blijdorp Hubs' abroad presents both opportunities and challenges in collaborating with local communities, environmental organisations, and governements to achieve sustainable conservation outcomes.

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introduction (continued): space for images

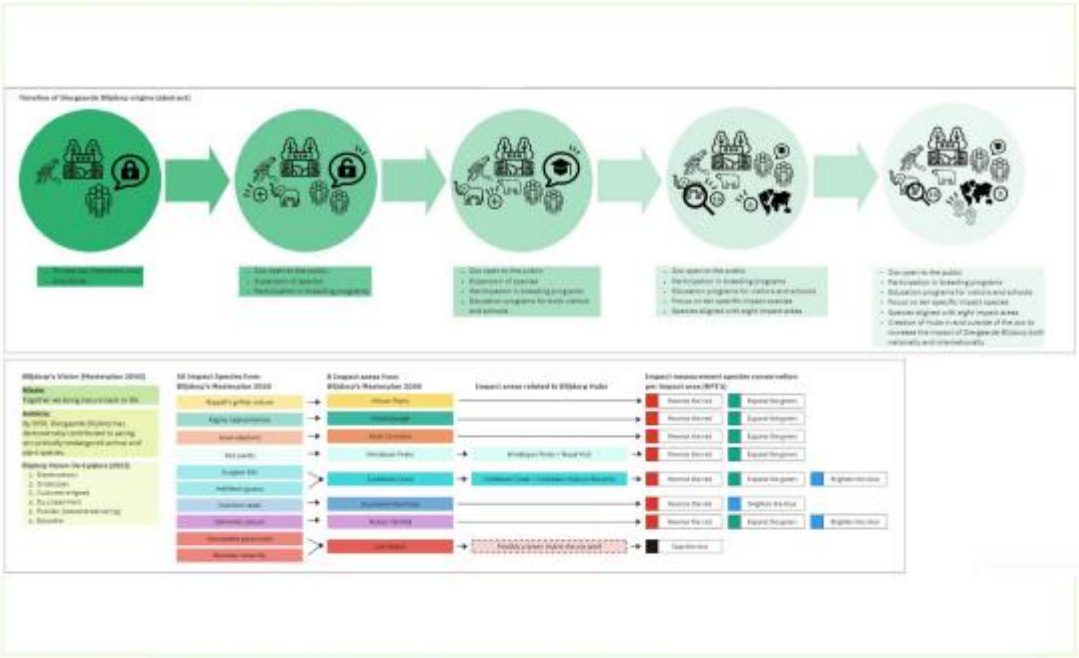

image / figure 1 Abstract timeline of Diergaarde Blijdorp origins and its vision

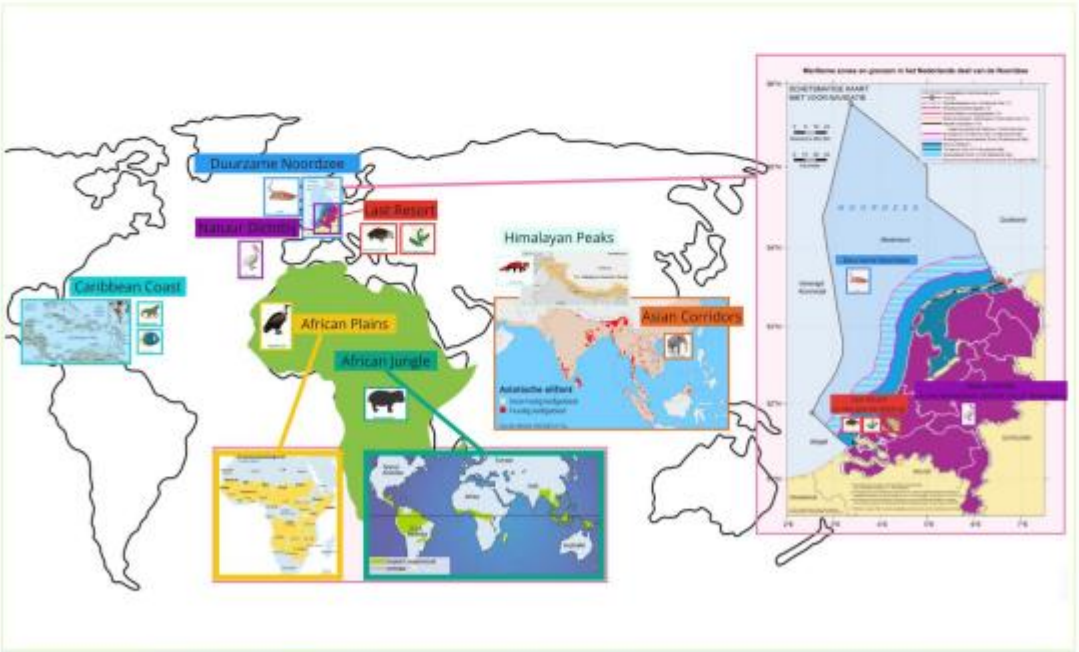

image / figure 2 Sketch: visual of Blijdorp's impact areas and corresponding impact species across the globe

DESIGN FOR our future

TUDelft

Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

The RoffaReefs initiative exemplifies Diergaarde Blijdorp's ambitious conservation strategy outlined in the Masterplan 2050, showcasing a successful model for coral reef restoration and fish population enhancement in Bonaire. However, the challenge lies in scaling this success to meet the broader conservation goals for the remaining nine impact species and eight impact areas identified in the Masterplan. By conducting a case study on RoffaReefs, I aim to identify key principles and methods that can be applied across Blijdorp's other conservation efforts. The primary opportunity lies in levaraging these insights to develop a versatile and scalable framework. This strategic framework will provide Diergaarde Blijdorp with a structured approach to monitor and assess its current and future product portfolio against KPIs based on the six pillars of its 2050 vision. It will serve as a blueprint to establish new conservation projects, enhancing their operational feasibility, stakeholder engagement, and ecological impact across Blijdorp's conservation efforts. This framework aims to facilitate the replication of successful conservation strategies derived from RoffaReefs and guide their implementation across different species and ecosystems. This strategic blueprint will add value for stakeholders, including conservationists, researchers, and local communities, by offering a replicable model that optimises resource allocation, fosters strong partnerships, and ensures sustainable conservation outcomes. This project aligns with Blijdorp's overarching goals of sustainable biodiversity conservation and environmental stewardship, positioning Diergaarde Blijdorp at the forefront of global conservation efforts by zoos, ensuring that its initiatives are impactful, sustainable, engaging to its audience, and fit for the future.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Design a strategic framework and roadmap for Diergaarde Blijdorp's national and international nature conservation and restoration strategy to guide the development and implementation of effective conservation initiatives (aligned with the Masterplan 2050 objectives), using the RoffaReefs initiative as a model for success.

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

For my graduation project, I will develop a strategic framework for Diergaarde Blijdorp's national and international nature conservation and restoration strategy. This framework will be based on a literature review, a case study on the existing RoffaReefs initiative within the Caribbean Hub and interviews with key stakeholders, including employees from RoffaReefs and Diergaarde Blijdorp, WWF-NL, DCNA, STINAPA, and the local community in Bonaire. This framework will assess how both current and future initiatives fit within Diergaarde Blijdorp's product portfolio, how they should be monitored, and how they should be communicated to the public. Following this, I will create KPIs aligned with the six pillars of Blijdorp's 2050 vision to evaluate, develop, and guide these initiatives.

The effectiveness of this framework and its accompanying KPIs will be tested and validated through a new project within the Caribbean Hub, specifically focused on the Antillean Iguana. Based on this testing, I will perform a brief iteration to evaluate the framework's effectiveness and help refine the framework.

Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting**, **mid-term evaluation meeting**, **green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	1 Oct 2024
Mid-term evaluation	20 Jan 2025
Green light meeting	17 Jul 2025
Graduation ceremony	25 Aug 2025

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	
For how many project weeks	
Number of project days per week	

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

Growing up on a houseboat, I developed a deep-rooted passion for water and marine life. As long as I can remember, I was intrigued and enthusiastic about this topic, spending a lot of my spare time doing all sorts of water sports and retrieving trash from the lake where I lived. In my BSc. Industrial Design Engineering, I developed a profound interest in sustainability and creating win-win-win scenarios within societal contexts. In my future career, I want to contribute to making the world a better place through sustainable and social innovation. This project aligns well with those ambitions and therefore I am really excited to work on it.

During my graduation project, I want to improve my competencies and become acqainted with new design methods and strategic management processes, such as product portfolio management. Moreover, I want to design an outcome that actually contributes to positive change. The challenge lies in ensuring that the project outcome is suitable for different organisations and contexts (ecosystems and species), while simultaneously being specific enough to be implemented. Additionally, I want to challenge myself with making 'quick and early' design decisions, as I tend to investigate different paths very thoroughly before deciding.

My biggest learning goal is that I want to learn how to effect change in large organisations such as Diergaarde Blijdorp by taking on an advisory (consultancy) role, while applying design thinking principles and a design thinking mindset. This allows me to understand how intrapreneurial thinking intersects with design and its applicability in the public sector.